LIBRARY OF CONGRESS SEP 12 1892 SMITHSONIAN DEPOSIT.

THE AMERICAN GAS LIGHT JOURNAL

REDMANAKENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LVII.—No. 11. Whole No. 901. | NEW YORK, MONDAY, SEPTEMBER 12, 1892. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order-registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C.O.D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—
- Briefly Told 361
  - Changes in the Management of the Laclede Company—Mr. Chollar's Recent Experiences—Another St. Louis Mention—An Indorsement of Our Opinion—The Goodwin Meter Company Sails into Calm Waters—Notes.
- On the Value of the Bye-Products of Gas Works, and on Improved Methods of Estimating them, by C. R. C. Tichborne, LL.D., etc. 362
- *Van Choate's Electric Photometer 364
- Notes on a Problem in Water Power 364
- The Use of Timber in Engineering Structures 366
- Shall we Utilize the Latent Abilities of the Managers and Workmen Engaged in Gas Works? by Mr. Gilbert Little 367
- Danger in the Grindstone 368
- The Improved Peebles Gas Governor 368
- The Utilization of Niagara 369
- Care of Tools 370
- An Ether-Oxygen Lantern 371

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 371
- To Enlarge the West Point (N.Y.) Gas Works—A Lawsuit at Port Hope—Mr. Macmun Goes to Marlboro—The Chairman of the Gas Commission, Mass.—Berlin Iron Bridge Company Contract—Troubles of the Vallejo (Cal.) Electric Light Company—Annual Meeting, Port Townsend, Wash.—Hints from Seattle, Wash.—The Loss by Fire at the Dennison (Texas) Works—The New Factories of the Messrs. Weber—Malicious Work at Rye, N. Y.—The New Company at Crookston, Minn.—Asphalt Pavement Deteriorated by Escaping Gas—To Close Out an Electric Lighting Company—Public Lighting, Minneapolis, Minn.—An Absconder Brought Back—Death of Capt. J. R. Miller—Mr. Sherman in Charge at Portage City, Wis.—Hints from Galena, Ills.—Office Building of the Derby Gas Company—And Other Items.

- The Market for Gas Securities 374

BRIEFLY TOLD.

CHANGES IN THE MANAGEMENT OF THE LACLEDE COMPANY.—Out of the West comes news that points to the conclusion that as the Standard Company of this city was so is the Laclede Company to be; in other words, that the cooks who are stirring up the broth there are either too nervous or too many—perhaps both. However, the bald facts in the case are these: On the 1st instant, Colonel W. A. Stedman, who has acted as General Manager of the Laclede Company for something over a year, retired from that position. Mr. Alexander Ross, the Secretary of the Company, assumed the duties of General Manager, without any change in his Secretarial capacity. It is hinted that Mr. Ross' appointment as Manager will be but temporary, yet in our opinion he will retain the berth for some time, since the nature of the changes looks as if the intention and object of the whole move was to save a salary through shifting and paring. Mr. Byron E. Chollar, formerly in charge of Station "A," has been appointed Engineer-in-Chief; Mr. Isaac H. Lionberger, the counsel to the Company, succeeds to the Vice-Presidency—a position that according to the Company's billheads has been filled by Mr. J. D. Thompson; and Mr. Arthur Finnegan, who for quite a while, in fact for a long time, has been acting in the capacities of machinist and mechanic at Station "A," succeeds Mr. Chollar in the Superintendency of the station. As stated before, the gist of the changes appears to be in respect of serving economy, and that, of course, is the Company's own affair; nevertheless, they have also another significance, in that they mark a spirit of unrest somewhere between the security holders and the executives of the corporation. In good time all that will be allayed, and the corporation is very likely to be there when the executives have been superseded. In the meantime it may be taken for granted that Colonel Stedman retires from his post with the sincere good wishes of the rank and file that he commanded with firmness and discretion, but without favoritism. We hope that he has not decided to keep out of harness permanently, for the industry cannot afford to lose men of his caliber from the active ranks.

MR. CHOLLAR'S RECENT EXPERIENCES.—Writing of St. Louis and Mr. Chollar, recalls to mind a couple of chapters in his recent history that are at queer variance. It has been said that good and bad fortune are closely linked, and Mr. Chollar would now in all probability, even if he would not so admit in the past, accede to the truth of the saying. We believe so because, on the night of August 30th, a burglar—the depredations of which class in St. Louis have been noted for boldness and frequency of late—entered Mr. Chollar's sleeping apartment and robbed him of a gold watch and a pair of gold spectacles. Mr. Chollar was awakened by the noise made by the fellow in his exit from the room, which avenue lay through an open window, but the thief made good his escape. The watch was especially valued by Mr. Chollar, since it was the timepiece presented to him by his associates in the Excelsior Gas Light and Coke Company, of Topeka, on the occasion of his resigning that charge to take hold at St. Louis. His promotion, however, furnishes the piece of good fortune that offsets in a measure the burglar's stroke, and there is reason for saying that if the executive management of the Laclede Company were imbued a trifle more with some of the qualities that go to make the man that Chollar is, they would not be in

such an unrestful state, as their "shifts" in the last twelvemonth would appear to indicate.

ANOTHER ST. LOUIS MENTION.—Evidently Mr. Frederic Egner, whose experiences in the troublous seas of the Laclede Company's waters are now a well authenticated chapter in American gas history, and who can speak with the authority of experience on what nervous executive management in the conduct of gas works really amounts to, has, as will have been noted through a reference to our advertising columns, settled permanently in St. Louis, there to take up the business of advising on all matters connected with gas and water works building. The firm name is that of Frederic Egner & Co., and their headquarters are in the Security Building, where it is needless to add both old and new friends will be welcomed and greeted. Mr. Egner is peculiarly well fitted for success in this field that he has chosen. He is a practical engineer, well-read, and tutored as well by long experience; is accurate, painstaking and honest, and can command capital. He is associated with a gentleman who will before long be almost if not quite as well known and well liked by the fraternity at large as Egner is himself. In these lights, how can the combination be other than successful? Frederic Egner & Co. have our best wishes for their unstinted prosperity.

AN INDORSEMENT OF OUR OPINION.—The following letter explains itself:

H. S. JACKSON & Co., 125 Milk St., Boston, Mass., Sept. 7, 1892.

To the Editor AMERICAN GAS LIGHT JOURNAL: I thank you for myself, and in behalf of New England gas interests, for your timely and excellent article, headed "A Dog in the Manger at Westboro, Mass."* It shows up methods which electric companies have long practiced, to the detriment of gas interests. Such a rebuke from the AMERICAN GAS LIGHT JOURNAL ought and will have a tendency to shame electric lighting managers into a semblance of fair play and honest intention. Advocates of electric lighting state that the use of gas is declining, and that sales of the latter are less every year. I copy the following from latest report of the Massachusetts Gas and Electric Light Commission: Gas sold in Massachusetts for year ending June 1, 1889, 2,737 millions cubic feet; for year ending 1890, 3,291 millions cubic feet; and for year ending 1891, 3,902 millions cubic feet. Of the 84 electric light companies in Massachusetts, only 25 paid a dividend last year. Of the 70 gas companies, 51 paid dividends, and of the 19 that paid nothing, 9 operated also electric light plants—which *may* account for lack of dividends. An increase in the sales of gas every year, of about 600 millions cubic feet, does not appear to bear out the statements so flippantly indulged in by our electric light friends. Yours very truly,

H. S. JACKSON.

THE GOODWIN METER COMPANY SAILS INTO CALM WATERS.—We have before us an official notification of the reorganization of the Goodwin Gas Stove and Meter Company, which hereafter is to be known as the Goodwin Meter Company. This authoritative announcement is a source of genuine pleasure to us, and we have no doubt that this pleasure will be shared in by gas men the country over, in that it shows that Mr. William W. Goodwin yet has the old fire that animated him, despite a fierce struggle with illness and a prolonged combat with business complications. Under the present management of the Company it is difficult to foresee where there is any chance for the development of inharmony, especially so when one knows that the supervision of the shops and the general management of the Company have been given over to Mr. H. B. Goodwin, who has been to his father a companion and with him as a co-worker for many years. The Company continues at the old shops on Filbert street, Philadelphia, and is now ready to fill any orders intrusted to it. All will be glad to know that Mr. Goodwin, Sr., improves in health right along.

NOTES.—A water gas plant of the Askins type is to be operated at Greensburg, Pa., by the proprietors of the concern formerly known as the Greensburg Natural Gas Company.——The Trustees of the Bellefontaine (Ohio) Municipal Gas Works have given notice that hereafter the rate on gas consumed for illuminating purposes will be 80 cents per 1,000; gas used for fuel purposes to be supplied at 30 cents per 1,000. Separate meters will be used.——These rates, particularly in respect of the fuel gas supply, are too low, and bad financial results are sure to follow. Admitting that the 80 cent rate is possible at Bellefontaine, a discount of 10 per cent. for a fuel gas supply would be more than equitable.

* See JOURNAL, August 29, p. 289.

On the Value of the Bye-Products of Gas Works, and on Improved Methods of Estimating Them.

[A lecture before the North of Ireland Association of Gas Managers, by C. R. C. TICHBORNE, L.L.D., F.I.C.]

When I was first asked to address this practical body of gas experts, I felt greatly complimented. But how was I to talk usefully to an assembly of men who had at any rate a much larger and more extended knowledge of gas making than I had myself? At first sight it was a puzzle; but I thought that, by taking up the subject of my present paper, I should be dealing with one upon which we could stand upon common ground, and yet one in which I could give you the outcome of special experience.

It is doubtful if the gas manager realizes the great ultimate value of the bye-products of his works, and that they are greater than the money value of the gas itself; this being specially so where coal is on the spot and gas is cheap. The reason that this is not apparent at first sight is that the gas manager, as a rule, values his bye-products as coke, gas liquor, and tar. But, to get at their real value, we must estimate them as coke, pure carbonate of ammonia, benzole, carbolic acid, anthracene, creosote oil, and pitch; for these are now commercial necessities, and are procurable from gas works alone. To obtain these ultimate products energy must be expended and money raised. If a process were introduced for commercially making alcohol or whiskey from coal gas (not by any means an impossible thing), the carbonizer would not then calculate his make as coal gas, but as whiskey—the most valuable product. As regards the ultimate products, we have values like £30 per ton for pure carbonate of ammonia, £300 for anthracene, £75 for carbolic acid, £6 for sulphuric acid, and coal tar colors varying from 8s. to 40s. per pound. If gas managers would take the trouble to multiply the whole of their yields by these sums, I have little doubt that many of them would be surprised at the results.

These remarks ought, in my opinion, to be sufficient to show the importance of the bye-products. Why do not the gas companies pay more attention to them, and, by the manufacture of these *ne plus ultra* products, save them from falling into other hands? It becomes necessary, therefore, that the estimation of the products should be conducted accurately; and as I have something new to say upon this subject, I bring it before the present meeting. It is an important matter to you, as the money value of these products has to be determined under the supervision of the gas manager. In olden days the gas manager had no output or market for these products; and he used to be indifferent to the purification of his gas as regards such items as ammonia and sulphur. The Gas Referees were obliged to invent a carefully considered method for the estimation, in the interest of the consumer, of these causes of impurity—a method which should present a fairly quick process, and yet should be accurate. Now, all is changed, and the manufacturer of gas finds these substances of such commercial value that he displays the greatest anxiety to separate them, as far as possible, from the gas. If he is not getting his proper proportion of ammonia and sulphur, it is so much money lost; and I am sure he would thankfully receive any suggestion of a process by which he could lock up the small residue of sulphur which still remains combined with the gas. He in many cases has to sell the bye-products on the unit of sulphur or ammonia they contain; and the estimation of these substances has become a question of the highest importance to him. Processes for the estimation of ammonia and sulphur are given by the Referees; but they are now a little old, and require revision in some details.

I will first introduce to your notice a few points about the estimation for ammonia. Some years since, I read before the Royal Irish Academy a paper under the rather scientific heading of the "Dissociation of Molecules in Solution." Although a purely scientific paper, it had indirectly a technical bearing. One of the points I endeavored to illustrate was that, on dissolving any salt in water, a partial dissociation took place between the base and the acid, though the salt might be quite neutral in the first instance. When dissolved, we have a free acid (or rather, I should say, an acid salt) with free alkali in the same solution and at the same time. This seeming paradox was known to exist in compounds in the gaseous condition; and it was found by experiments to also exist to a more limited extent in compounds when in solution. This state of "dissociation" is specially marked when we are dealing with ammoniacal salts, or any salt where one of the radicals is gaseous. Thus, if we throw neutral sulphate of ammonia into water, a small quantity is instantly dissociated, and, instead of the salt, we have free acid and free ammonia.

A second point was also elicited by my experiments—namely, that the extent to which this decomposition is carried is regulated by, and is in

ratio to, the temperature. I will illustrate this by a pretty experiment which will make plain my meaning. Here are two flasks, each containing 10 oz. of water, and in one is placed 20 grains of sulphate of ammonia—the very salt which we shall see plays an important part in the estimation of ammonia in gas liquor, or in determining the purity of the gas. It is a salt in which a strong acid is combined with the weak base, ammonia. I use for the purpose of showing the acid or alkaline condition of these salts an indicator called phenolphthalein. It is one of the beautiful coal tar dyes. Any indicator would do; and I merely select this one because it is so plainly seen. The condition is not shown, as it is in the others, by a transition of colors, but is colorless in acid solutions, and a brilliant magenta color in alkaline liquors. I have thus an indication by which you in the distance can detect with ease the condition of the contents of the flask. The flask containing the sulphate of ammonia has been rendered faintly alkaline with ammonia; and you will observe that the contents are bright red. To keep this fact green in your memory, I have affixed a red card to the flask. In the second flask, I have placed 20 grains of sulphite of soda, in the same quantity of water.

Here again I have added phenolpthalein; but as the salt is faintly acid, we have in this flask a colorless solution, and I again mark the fact by attaching a white card. We will now place the two flasks over Bunsen burners, and you will see this curious phenomena take place. As they get hot, the white solution gradually becomes pink, and ultimately magenta, while the red solution grows paler and paler until it becomes water white. In fact, the acidity and alkalinity of these two solutions have become reversed by the action of the heat, which is evidenced by their change of color. The dual phenomenon is due merely to the rise in temperature in each case disengaging the acids and alkalies. They are, in fact, both really free, but as sulphuric acid is a very strong one, it affects the indicator first; and in the case of sulphurous acid, it being so weak, the base wins the battle, and the reverse phenomenon is produced. That this dissociation is only temporary, can be easily shown; because, on placing the vessels half submerged in ice water, you will see the lower stratum of fluid in both flasks regains its old color.

Now, it is self-evident that the temperature will have an immensity to say to the estimation of ammonia by a volumetric solution of sulphuric acid. Both the process of the Referees and the gas manager's practical method for gas liquor consist in estimating in this manner, and in using an indicator to show when we have employed a sufficient quantity of the volumetric solutions to produce a neutral compound. But I have shown that this point varies with the temperature, and that, if we are to get correct results *the volumetric solutions must be made and titrated at a standard temperature (say 62° F.*), and all estimations must be performed at that temperature.* Directions for temperature, etc., are not touched upon either in the Gas Referees' or the gas liquor process. The use of volumetric solutions of ammonia should also be discarded for volumetric solutions of soda. The soda produces much sharper and more reliable results, as it introduces less of the unstable ammonium compounds.

I subjoin details of an actual experiment as an illustration of these remarks. The lower of the temperatures taken illustrates what would be found in the laboratory in winter—viz., 50° F., while 70° F. is a common temperature in gas testing stations during the summer. Solutions at 62° F. of ammonia and sulphuric acid were made, having such a strength that, at 62° F., 50 c.c. of the volumetric solution of ammonia exactly neutralized 10 c.c. of the sulphuric acid; 50 c.c. of the ammonia solution were then exactly neutralized at 50° F., when it was found that 10.2 c.c. of sulphuric acid were required at this temperature. The solution was then warmed to 70° F., when it was found that 0.3 c.c. more of ammoniacal solution were required to neutralize. So that we find the difference is as follows—

At 50° F..... 10.2 c.c. = NH_3 0.1734 gramme.
At 70° F..... 9.9 " = " 0.1683 "

0.3 c.c. = NH_3 0.0051 gramme.

As the experiment was performed on 50 c.c., it is a difference of 0.01 of ammonia on 0.34, or 3 per cent. (2.9).

We see from the above experiment that, if the volumetric solutions have been made at the normal temperature, an approximation to accuracy would be obtained by adding or subtracting, as the case may require, 1.5 per cent. for every 10° F. observed at the time of the experiment.

* Most volumetric measures, etc., are graduated at 60° F.; but (though the error is slight) this graduation is wrong, because the imperial gallon, upon which the gas manager bases his calculation, is standardized at 62° F.

I will now pass on to the subject of sulphur—another of the most valuable bye-products of gas works. I need not describe here the process of the Gas Referees for the estimation of that substance, and their well known arrangement for the condensation of the products of combustion. This simple yet elegant process consists essentially in burning a small flame of the gas slowly in an apparatus arranged for the condensation of the products of combustion. The gas is burnt in an atmosphere of ammonia, and the sulphur is supposed to be fully oxidized and carried with the other products of combustion into the condensed liquor. But the oxidation is not perfectly done, however carefully the process is carried out. It was proposed by the late Mr. T. W. Keates, in the first instance, and afterwards indorsed by Professor Wanklyn, that iodine should be introduced into the apparatus in place of carbonate of ammonia.

This will, no doubt, effect the conversion of the lower oxides of sulphur, so that they will all be precipitated as sulphate of barium. But there are in my mind sundry objections to the iodine which are well worthy of consideration, if a better process can be devised. In the first place, iodine is very costly—a consideration in a process which is always going on; secondly, manipulation with iodine stains the hands, while the fumes are unhealthy, and corrode all the brasswork of the instruments in the laboratory. Bromine has been tried by myself with marked success; but all the objections which apply to iodine apply with even greater force to that element.

The substance which I have ultimately found to answer all purposes is peroxide of hydrogen of the strength of 10 volumes. In practice, the use of this compound is simplicity itself, and attended with no more inconvenience than the use of water. In the Referees' process, some of the sulphur escapes oxidation into sulphuric acid; and as the lower oxygen acids of sulphur do not produce compounds with barium which are insoluble, they are washed away. I will illustrate this by a simple experiment.

I have here the products of combustion of 10 cubic feet of gas, procured by carrying out an experiment strictly according to the Referees' process. It has been precipitated by barium chloride solution, and filtered from the sulphate of barium, which should really represent the whole of the sulphur present. I will now add another ounce of the barium chloride solution, first to demonstrate to you that all the sulphate has been precipitated; and, secondly, to have present an excess of barium. I now add an ounce of the peroxide of hydrogen, and you will see that in a few seconds the liquor becomes milky from further sulphur compounds which the Referees' process had failed to catch. The reaction may be represented by the following equation—

SO_2	+	H_2O_2	=	SO_3	+	H_2O.
Sulphurous anhydride.		Peroxide of hydrogen.		Sulphuric anhydride.		Water.

As commercial peroxide of hydrogen sometimes contains traces of sulphuric acid, it is desirable that a little solution of chloride of barium be added to the stock bottle, and the supernatant peroxide decanted for use. In practice, it is only necessary to add the ounce of peroxide immediately preceding the boiling in the Referees' process.

The following table will illustrate the difference in the results obtained in actual practice—

Grains of Sulphur per 100 Cubic Feet of Gas.

	Referees' Process.	Bromine Process.	Peroxide of Hydrogen Process.
Experiment 1.....	10.11	18.24	18.14
" 2.....	13.15	20.18	19.98
" 4.....	13.42	21.00	20.92
" 6.....	17.24	25.18	25.20

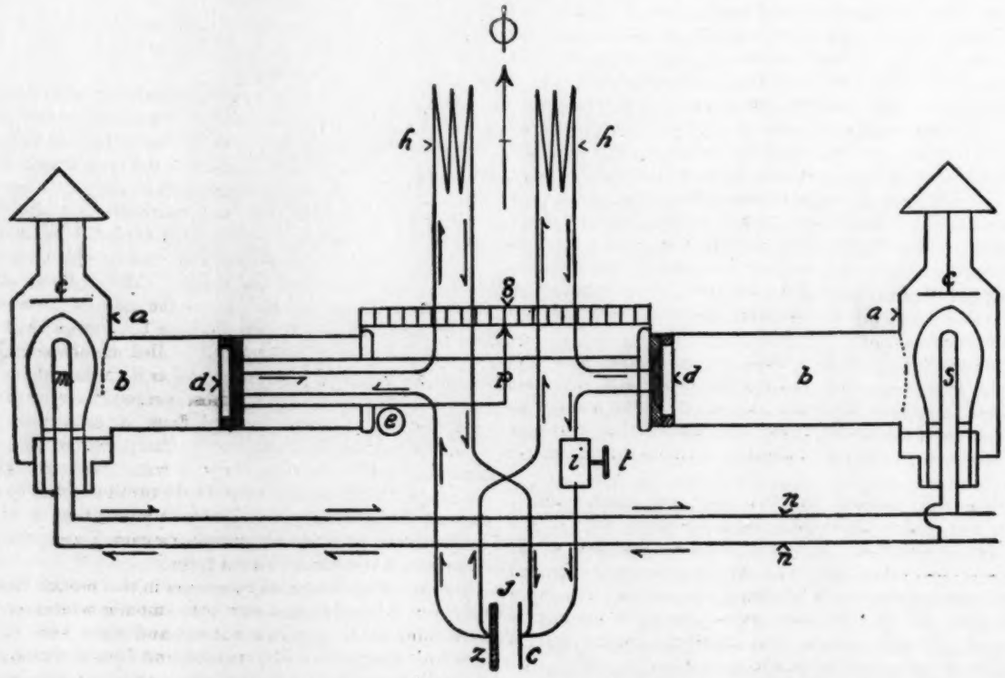
If time would permit, I might enlarge upon the question of how the yield of these bye-products could be increased; but this subject would land me far beyond the limits of one discourse. There are some which are allowed to escape altogether, and which actually entail considerable expense in removing. Thus, every ton of coal gives 10 per cent. of carbonic acid gas, which, when liquefied, constitutes a commercial article worth about 2d. per pound. As you are now no doubt aware, by a patent originated by me, this same gas was some time ago a waste product in the breweries, but is now extensively reclaimed at Messrs. Guinness's and other establishments. Why should not the gas manufacturer utilize to advantage his 10 per cent. of carbonic acid gas?

In conclusion, let me remark that when the time shall come, that the tidal wave or the falling river shall grind electricity out of the bowels of the earth free of cost, coal will still have to be carbonized for these valuable bye-products, which, in my opinion, are not estimated at their proper value, either in the gas manager's mind or in actual practice.

Van Choate's Electric Photometer.

In a recent issue the *Scientific American*, in calling attention to devices for measuring the illuminating value of electric lights, remarks that on account of the difficulty of eliminating the personal equation, photometric work has always been attended with a great deal of uncertainty, and an instrument for the measurement of light, whose accuracy does not depend upon the sense of sight, has long been needed; but since the days of gas lighting, and more especially of electric lighting, a reliable instrument has become an absolute necessity. Various ways have been suggested for avoiding the uncertainty of the ordinary photometric methods, but the best device for the purpose that has come to our notice is the invention of Mr. S. F. Van Choate, of Boston, which he has given to the world without price or the expectation of reward.

In this instrument—which is shown in the annexed diagram—a selenium cell is employed to receive the light beam, and to thus vary the electric current which is made use of to give the visual indications. The instrument is in the nature of a balance connected with a differential galvanometer, the standard light being arranged to affect one side of the balance, and the light of unknown strength being placed upon the opposite side of the instrument. The tubes *b* of two lanterns *a* are preferably arranged axially in line. In the right-hand lantern is placed the light *s* to be tested, above which is suspended a disk *c* for



preventing the escape of light. In the other lantern is placed the standard lamp *m*, and in the tube *b*, upon the same side of the apparatus, is fixed an adjustable selenium cell *d*, which is moved along the length of the tube *b* by the pinion *e*. To the selenium cell *d* is attached an index *p*, which slides in front of the scale *g*. If the standard lamp and the lamp to be tested are electric lamps, they are connected up in an electric circuit in the usual way.

In the upper portion of the diagram is shown a differential galvanometer, which is connected with a battery *j*. The right-hand coil of the differential galvanometer is connected by one of its terminals with the zinc plate *z* of the battery, while the remaining terminal of the coil is connected with the selenium cell *d*, which in turn is connected, through the rheostat *i*, with the carbon plates *c* of the battery. In a similar manner one terminal of the left-hand coil of the galvanometer is connected with the carbon plate *c*, and the remaining terminal is connected with the adjustable selenium cell *d*, from which a wire extends to the zinc plate *z* of the battery. The two branches of the battery circuit are placed in electrical balance by means of the rheostat *i*. The selenium cells *d*, being alike, if the lamps, *s*, *m*, are equal, the distance between the selenium cells *d* and their respective lamps will be the same. If, however, the lamp to be tested is inferior to the standard lamp, the selenium cell *d* which faces the standard lamp will be moved until the galvanometer indicates equilibrium. The difference in the distance between the selenium cells and the lamps, as indicated on the scale, will give the basis for the calculation of the relative intensities of the light from the two lamps, calculations being made according to the law of inverse squares.

This instrument can be used in measuring the intensity of light from other sources by simply adapting the lanterns to the kind of light used for standard and for testing.

Notes on a Problem in Water Power.

[By Mr. John Richards, Mem. Am. Soc. Mechanical Engineers, of San Francisco, Cal.]

The present paper is to be a non-scientific one, and in other respects is not to be classified among the contributions such as are commonly presented before this Society. Neither are its objects the same. The purpose is to present some thoughts upon a very important subject, with a view to calling out further and more able discussion. There being nothing exact or determinate to deal with, there will be neither figures nor quantities included, so that no severe mental strain need be apprehended in following the remarks.

The subject is water motors, or, as we commonly say, water wheels, for utilizing the action of gravity of water, and an inquiry into the probable conditions, inferences, or deductions which have led up to and established modern practice as it now exists in this country.

Water wheels, as we have to deal with them, may be classed as gravity wheels, including (1) overshot breast wheels, and perhaps the Poncelt type; (2) pressure wheels, including what we call inclosed turbines and reaction wheels; (3) impulse wheels, driven by spouting water.

The classification thus assumed is, for short: Gravity, pressure, and impulse wheels. These may be said to cover the various types in common use.

In modern practice the class called pressure turbine wheels constitute perhaps four-fifths of the whole. These can be divided into three general types—namely, the Fourneyron, or outward radial discharge; the Jonval, or downward discharge parallel to the axis of rotation; and the American or inward flow wheels. These have come into general use all over the world, and have a literature of surprising completeness. They are by common consent regarded as the most efficient, and, indeed, until recently, have been the only wheels which were considered in connection with an efficiency of over 60 per cent.

The question to be presented, and the main point in this communication, is, what has produced this particular form of evolution in water wheel practice, and why has pressure instead of impulse been the principle or mode of operation followed in all countries?

Before attempting any answer to this inquiry, it will be well to further examine or explain, in as simple a manner as possible, the nature of the class called turbine wheels.

A column of water resting upon the vanes of a turbine wheel, which

are free on their reverse side, and meet no resistance there, represents complete efficiency less machine friction; and the science of turbines, to so call it, is directed to removing the impeding water and its resistance on the reverse side of the vanes—that is, on the discharge side, after the function of pressure has ceased or has been utilized. It is common to divide the effect of the water, or its functions, in this class of wheels, into gravity, impulse, and reaction; but there is no need of such assumption, or of introducing the complex nature of these forces thus combined, because the whole is explained as simple pressure, and all observed phenomena point to this as the "mode of action" in pressure turbines.

I am in this assumption, no doubt, transgressing upon what are called established data, but the issue is not important to the present subject, and it will be sufficient to call the active force one of pressure alone, and the resistance or loss a result of the imperfect riddance of the water on the reverse or discharge side of the vanes, after is has performed its work by pressure, impulse, or otherwise.

Following this method of operating to its constructive features, it involves closed vessels, or conduits, not only to the water wheels, as in other cases, but around them. The wheels must be enveloped in the fluid that drives them, and contained in cases strong enough to sustain not only the static head, but also the effect of water concussion, and in most cases afford support for the wheels themselves and their shafts.

The bearings of the wheels have to sustain the weight of the running parts, also, in many cases, a pressure of the head equal to area of the issues multiplied into the head. The wheels are submerged, placed at the bottom of the head or near it, inaccessible to observation, and also for repairs, calling for unusual and expensive provision in the way of bearings and other constructive features, including extra strength in all parts. The hydrodynamic conditions both of entrance and discharge call for complicated forms that cannot with safety be built up, and pressure turbine wheels in this way become large and expensive castings, the value of which depends upon the integrity of every part. If a vane be broken or imperfect, the whole wheel is lost. The diameter being limited because of first cost, a limit of rotative speed is reached at a head of 50 feet or so, and even at that head the bearings have to run under undesirable conditions; in other words, this type of wheels does not permit control of rotative speed, that being limited by both first cost and operating conditions.

Turning now to the other type of wheels, but little known in this country, except on the Pacific Coast, the impulse class, and assuming that the force of spouting water is equal to its gravity less an inconsiderable friction in orifices, the question arises, why has not the evolution of water wheels followed on this line instead of pressure for all except low heads?

This is a very important question, one that may well engage the attention of this Society, and one that calls for explanation such as will be by no means easy or apparent. It is true that with that class of impulse wheels called "undershot," and some other cruder forms operating by the impulse of spouting water, the efficiency attained has been so low as to lead to the conclusion that the losses were inherent in the method or mode of operation, and this opinion has, it seems, become general without any one very closely inquiring into the matter.

That the efficiency of tangential wheels driven by impulse is as high as can be attained by pressure turbines, has been proved by numerous experiments here, also by some recent experiments at Holyoke, Mass., and is beyond controversy. It has long been settled on this Coast, and as a problem no longer exists. No one here would expect under a head of 50 feet or more to attain with any known type of pressure water wheels a higher efficiency than is given out by tangential impulse wheels; but this state of opinion and practice is confined to narrow limits now, and is the more to be wondered at when we consider the rapidity and completeness of investigation in other branches of dynamic engineering at the present day, especially when the economic and constructive conditions in favor of the impulse type of water wheels are taken into account. These we will now consider in a brief way.

There is a wide difference between a water wheel driven by impulse and one operating on the pressure system. The first cost of the former, for a given power, is one-half as much, and its maintenance is still less, in proportion.

Figuratively speaking, when a wheel is changed from the pressure to the impulse system, it is taken out of its case, mounted in the open air, in plain sight. All the various inlet fittings are dispensed with and are replaced by a plain nozzle and stop-valve. Its diameter is made to produce the required rotative speed, whatever that may be. The shaft and its bearings are divested of all strains except those of gravity and the stress of propulsion when the water is applied at one side only. Most important of all there are no running metallic joints to maintain against the escape of water, no friction and no leaks; there are, indeed, no running joints or bearings whatever, except the journals of the wheel shaft.

The effect of grit and sand is eliminated, both as to vanes and bearings, and there are no working conditions that involve risk or call for skill. If a vane is broken, another one is applied in a few minutes' time. If a large or small wheel is wanted, the change is inexpensive and does not disturb the foundations or connections.

Capacity is at complete control; the wheels can be of 10, 100, or 1,000 horse power, without involving expensive special patterns. The speed of rotation is not confined to commercial dimensions because of patterns and other causes. It is merely a matter of choice with the purchaser or maker.

Now, granting the efficiency of impulse wheels, which, as before remarked, can hardly be called in question for all heads exceeding 50 or even 30 feet, and conceding the constructive and operating advantages just pointed out, the question at first named, why has the evolution of water wheels during 50 years past been confined to the pressure class? Also, why has it been proposed at Niagara Falls to employ pressure turbine wheels under a head of 100 feet or more, when the conditions point to the better adaptation of open or impulse wheels?

It is not necessary in such an inquiry to discuss the problem of horizontal and vertical axis, or other local conditions, in the case of the Niagara plant, or in any other, further than to say that the pressure class of wheels offers no advantages not balanced by equal or greater disadvantages, as will no doubt appear if there should be discussion on this subject before the Society.

Besides the object of this communication first named, there is the further one of calling the attention of the members present to the impulse or open water wheels so extensively employed on this Coast, and to suggest that, if possible, they manage to see such wheels in operation under various heads—especially under high heads. In observing a machine of any kind in motion, there are impressions gained which cannot be conveyed by description; but I warn everyone against inference from this remark that the tangential water motor wheels on this Coast are not scientifically understood and treated. The problems involved may not be so many or so intricate as in the case of pressure turbine water wheels, and this is fortunate, because the literature of the latter is one of much complexity to any but skilled mathematicians, and for that reason has not been of so much use as it ought to have been.

In this country, and it is a most commendable thing to mention, the pressure turbine by an inward flow, or an inward draft, has been greatly simplified in construction, cheapened in first cost, and at the same time better adapted to impure water, without losing anything in efficiency. I believe the inward flow turbines made by the Risdon Company at Mount Holly, N. J., have in public tests on more than one occasion shown an efficiency as high, or even higher, than the more finely fitted Fourneyron and Jonval types.

The record of American engineers in this branch is one of which they may well be proud; and now that impulse wheels of the Girard type have made much progress abroad, and have here in California been modified much as the Fourneyron and Jonval wheels have been in the Eastern States, it is quite time more attention was bestowed upon the subject in other parts of the country. Analogy in the two cases is marked. By an inward flow, American makers reduced the running parts, or the wheel proper, of pressure turbines to a small diameter, increasing its speed accordingly. This lessened the weight and cost of the wheels in the proportion of their diameters, and at the same time dispensed with the accurate fitting involved in the outward and downward flow turbines; and this, as before said, has been done without sacrificing efficiency.

The tangential type of open wheels has been similarly dealt with here in California. The running-water joints have been wholly dispensed with. The construction has been cheapened one-half. The round jet has been applied in the most simple manner, with an increased dynamic effect, and the efficiency attained is believed to be more than is reached by the finest examples of Girard wheels in Europe.

Conceding these statements and facts brings us back again to the query forming the subject of this communication—namely, Why has the evolution of water wheels followed on the line of *pressure* instead of *impulse*?

GEORGE T. MORAN, 21 years of age, while working on the crown of the gas holder that is being constructed for the Quebec (Can.) Gas Light Company, lost his footing and fell to the ground. He was instantly killed. It is alleged that the insecurity of the *derrick* gearing was responsible for the disaster.

The Use of Timber in Engineering Structures.

Engineering, some time ago, was led to remark that one of the distinctive features of foundations in America, as opposed to present European practice, is the readiness with which timber is used, though this statement would also apply to other pieces of construction. The main reason for this has no doubt been the facility with which it could be procured and its comparative cheapness, but also because this material has the advantage of being readily put into place, particularly in sub-aqueous work. A very common plan has been to construct a crib of squared timbers drift-bolted together; this forms almost the entire under-water foundation, as it extends from the river bed up to within 2 ft. or 3 ft. of the low-water mark, at which level the masonry is started. Such a crib is easily floated into place. It would, however, naturally float with about one-third of its height out of water, and it is, therefore, the practice to load such crib with stone built up inside it to reduce this amount of freeboard, and when floated to its resting place the crib is finally sunk by filling up cells left in it for the purpose. In this way no expensive plant is required, the material can often be obtained near the site of the works, and freight is saved. It is not even necessary that the timber should be seasoned, and though the practice is now to build the crib of squared sticks, yet this is not essential, as round logs have been successfully used. Of course in salt water such foundations would be liable to be destroyed by marine worms, but when constantly submerged in fresh water, timber, even of the softest kind, will apparently last for ever.

It is, of course, necessary that a level foundation shall be prepared for the crib to rest on, either by dredging, piling, or raising a rubble mound. As regards the second alternative, the American engineers have probably had more experience in the use of piles than those of any other nation, as the long wooden trestles so frequent on American lines are frequently thus supported, and many important bridges have been erected on this type of foundation. Probably no question has been more disputed than that of the allowable load on piles, for determining which formulæ of the most complex character have been proposed. Such formulæ, though they do great credit to the ingenuity of their authors, are a kind to disgust practical men, who have, as a rule, preferred to rely on the results of their experience.

The old so-called rational formula led to the result that the supporting power of a pile on hard rock, in which the penetration would be nil, was infinite, an obviously absurd result. Attempts have been made to modify the formula by taking account of the elasticity of the pile, but they all lead to complicated forms. A simple formula was, however, proposed some years since by *Engineering News*, which gives good results in practice, and though not altogether rational, it is, at least, as much so as Gordon's formula, which has been used for so many years past for ascertaining the practical strength of iron and steel columns. Like that formula it agrees very well with the rational formula for a wide range, but where the latter leads to results at variance with practice, the semi-rational formula gives reliable results. The formula in question is

$$\text{Bearing power of pile} = \frac{2 \times \text{weight of monkey} \times \text{height of fall in feet}}{\text{Last penetration in inches} + 1}$$

Ordinary common sense must, of course, be used in employing this formula. The penetration of the pile should be fairly uniform for a number of blows, and there should be no brooming of the head. The fall of the monkey should not be excessive, say not more than 25 ft. The final penetration permitted is often as much as 2 in. or more, with a one-ton hammer and a 20-ft. fall. The cost of piles in place is often remarkably low, as little as 8½d. per foot in favorable cases. In a recent contract in which piles 60 ft. long were to be driven under water, the price was only £2 12s. per pile.

Even when the foundations are put in by the pneumatic method, the caisson is almost invariably built of wood, 12-in. or 14-in. squared timbers drift-bolted together, forming both the curb and the roof of the working chamber, the necessary strength for the latter being obtained by constructing it of several layers, crossing each other at right angles. Caissons built in this way cost about 1s. 6d. to 2s. per cubic foot of timber in place.

In the case of the Poughkeepsie Bridge, in which the foundations were put in by the Indian well method, wood was again used for the cribs, the largest of which was 100 ft. by 60 ft. in plan, having 14 dredging pockets, giving a clear opening of 10 ft. by 12 ft. each. The top of these cribs was surmounted by the bottom of a timber caisson 6 ft. thick. At a distance of but a few feet below the water line the masonry was commenced, so that up to this level, a distance of upwards of 100 ft. from the bottom of the foundation, the pier is mainly wood. In using cribwork in this fashion it is necessary to guard against the destruction of the crib by the buoyancy of the upper parts pulling out the spikes which hold it together. An accident of this nature occurred with one of the piers at Poughkeepsie and led to experiments on the holding power of spikes in the timber used. These spikes, 1 in. in diameter, and driven into $\frac{13}{16}$ in. holes in hemlock, were found to have a holding power of 422 lb. per linear inch. Even before this the United States Government had made experiments on the subject and established the important fact that the holding power of such bolts increased with age, that smooth bolts held very much better than ragged ones, and also that it required 40 per cent. less power to draw a bolt through a hole than to draw it out. These experiments also showed that round bolts held better than square. Bolts driven with the grain have only one-half the holding power of those driven across it. The following table shows some of the results obtained by various experimenters.

	Size of Hole. in.	Size of Bolt.	Kind of Wood.	Holding Power in Pounds per Linear Inch. lb.
United States Government experiments	13-16	1 in. round.	White pine.	833
United States Government experiments	13-16	1 "	Norway pine.	750
Brooklyn Bridge	15-16	1 "	Georgia pine.	1,000
" "	14.16	1 "	"	1,400
J. B. Tscharner	15-16	1 "	"	500
"	15-16	1 "	Oak.	1,300
Powell & Harvey	1	1 in. square.	Pine.	662
" "	15-16	1 "	"	710
" "	14-16	1 "	"	777
" "	13-16	1 "	"	675

In the case of foundations the dimensions are usually so ample that the question of the strength of the timber used hardly enters into consideration, but in other structures this is not so. No doubt in most cases experience of previous structures is a sufficient guide to the proportioning of a new one, but in connection with the proposed Chicago Exhibition this question of the proper working unit stresses for wooden structures has been brought into prominence, and the subject was discussed at some length before the Western Society of Engineers. The stresses proposed by Mr. Gottlieb, who had charge of the designs for the buildings, were 600 lb. per square inch, in posts and pillars, and 1,500 lb. per square inch extreme fiber tension in caps and joists. Both these figures are exceeded in ordinary every-day practice without accident, and there was a consensus of opinion at the meeting that the scare raised in the Chicago daily papers, which led to Mr. Gottlieb's resignation, was unwarranted. The enterprising reporter of the latter day press has, however, always considered himself competent to instruct experts in all the details of their business. Provided only he can make a sensational article out of it, he appears to care but little for the accuracy of his information.

In the discussion already referred to, Mr. Bates, Bridge Engineer of the Chicago, Milwaukee and St. Paul Railroad, stated that the calculated working stress in the extreme fiber of the trestle bridges, so commonly used on American lines, under the engines which ran over them daily, varied from 1,083 lb. per square inch up to 1,743 lb. per square inch. When it is considered that these stresses are used in daily practice in structures carrying heavy passenger and goods trains, and that the true stress, owing to surface cracks due to seasoning, is probably considerably more, it appears that Mr. Gottlieb's stress of 1,500 lb. per square inch in a building which will exist during less than two years is a very moderate one. The bearing pressure of 600 lb. in the columns is the same as that commonly used in New England mills, where wood is extensively used for both columns and floors. Quite recently Mr. J. B. Stanwood has proposed a straight line formula for the unit stress in wooden columns based on an analysis of the results of a large number of experiments on full-sized columns. His rule is working stress in pounds per square inch $= 1{,}000 - 10\frac{l}{d}$, where l = length and d = diameter of the column.

As regards the bearing pressure of the post on its cap, experiments made at the Watertown Arsenal showed that a pressure on pine perpendicular to the fiber of

846	lb. per square inch	caused an indentation of	.01	inch.
1,000	"	"	.02	"
1,077	"	"	.03	"
1,121	"	"	.04	"
1,153	"	"	.05	"

It is instructive to note how rapidly the compression increases as the load goes up, but certainly a compression of less than $\frac{1}{16}$ in. is perfectly safe even for a permanent structure. In the direction of the grain, timber will, of course, stand a much higher pressure, ranging in amount from $2\frac{1}{2}$ to 3 tons per square inch for short specimens.

Shall We Utilize the Latent Abilities of the Managers and Workmen Engaged in Gas Works?

[Communicated by Mr. Gilbert Little to the *Journal of Gas Lighting*.]

Mr. George Livesey, Mr. Foulis, and other prominent personalities connected with the gas industry, have, as we all know, given attention to and formulated schemes to stimulate the interest of the workmen. In bringing this question, therefore, before the readers of the *Journal*, I am so sensible of its importance that my only hope of arriving at its solution depends upon receiving, not only sympathetic assistance, but also the most cordial appreciation of the difficulties inherent in such an inquiry; and, moreover, with a predisposition on the part of engineers and managers to prosecute that inquiry in a spirit at once bold and generous. The scheme which I purpose submitting for consideration is not, in principle, altogether novel. In a limited form it has already been tried, with excellent results, in a great engineering establishment wherewith I am proud to have been connected; and to the partners of that firm belong the honors of making the experiment. But it rests with the engineers and managers of gas works to decide whether, by making the principle applicable to the utilization of the abilities latent among the entire body of managers and workmen connected with their great industry, this scheme shall, to their honor, be invested with far-reaching and beneficent effects.

The question which at the outset of the inquiry naturally confronts us, resolves itself into this: Does there exist, among the managers and men connected with gas works, latent ability which is worthy of being stimulated and utilized! Although this question might be at once answered by a simple affirmative, it may be worth while to devote to it a more lengthy reply.

It is not, perhaps, too much to say that the mechanical agents in gas making suffered immunity from the inventive spirit which marks the fourth, fifth, sixth (and perhaps the seventh) decades of this century longer than any other department of mechanical art. The conditions under which gas making is conducted tended during these named decades to the exclusion of improvement. Every district (indeed, it might be said every hamlet) drew its supplies exclusively from the works within its own circumscribed limits; and, in consequence, the most potent spur to inventive research—namely, competition—was altogether absent. Besides, the gas manager, by reason of this local isolation, had little or no opportunity of adding to his own stock of industrial knowledge those hints of reform to be derived from associating with his fellow-craftsmen, the results of which are so apparent in those industries which draw large bodies of men into daily competition and intercourse. Such conditions were obviously hostile both to a spirit of inquiry and the adoption of improvements.

I refer not only to managers, but to their workmen. The remark applied to both with equal force; for, inasmuch as no competition prevailed among the works, there was no spirit of emulation existing among the men. The conditions which obviated the former deadened the latter, and, therefore, the instinct which exerts the most potent influence over the intensity of man's efforts played, until quite recent times, little part in gas making.

The *status quo* was, in fact, one of stagnation. The assumption of finality in the principle of house lighting being reached, had taken root; and it can hardly be a matter of surprise that it now seems as if the heritage of practice, which had been pursued by successive generations, was found on examination to be destitute of the necessary elements applicable to the requirements of the time, and that the gas industry—managers and workmen alike—find themselves brought face to face with an entirely new order of things more or less complex, touching which they have few traditions to guide them, or experience derived from those who have gone before them to afford enlightenment. They are brought to examine a new order of things for the first time. A powerful competitor has arisen. Their minds, therefore, are active with speculation and inquiry. Their whole forces are engaged in canvassing the adaptability of certain means to specific ends; and generally the relation of the one process to the other. They are, in point of fact, standing on the threshold of inventive research, and the entrance to a period (provided their possibilities are fully recognized) of great progress.

The present, therefore, is an appropriate time, I think, taking due cognizance of the prevailing attitude, for invigorating the awakened ability, so long, by the force of their surroundings, allowed to remain latent in the workmen, and imparting to it a strong and definite bent.

That being so, I ask the engineers and managers to consider the elements of a scheme, subject to modification, calculated to suit the situation and promote the object for which I am contending.

1. I propose the establishment of an "Inventions Committee" in connection with the different Associations of Gas Engineers and Managers, whose functions it shall be to decide upon the merits of inventions or discoveries submitted to them, and the granting of money awards where warranted. This Committee, I propose, shall consist of seven gas engineers and three trading engineers, to be elected annually. The grounds on which a manager or workman may claim an award from the Committee might be formulated as follows:

   (*a*) That the claimant for the award has been a bona fide employee in a gas works for at least three months immediately prior to his application.

   (*b*) That he has invented a new machine.

   (*c*) That he has discovered or introduced any new methods of carrying on or arranging the works.

   (*d*) That he has improved any existing appliance.

   (*e*) That he proposes any change in the method of bookkeeping or apparatus for obtaining or formulating records capable of effecting a more correct or expeditious business check.

   (*f*) Or, generally, that he proposes any change calculated to increase the utility of the machinery, or render the products superior in quality or more economical in cost.

2. In the case of a manager or workman who is unable to test the merits of his supposed invention or improvement, either through inability on his own part to make the necessary experiments, or to pay for the same, the Committee may decide to bear the whole part of the expense of doing so; and if the invention should afterwards prove a success, an award should be granted.

3. Every claim submitted to the Inventions Committee should be minuted at the first meeting after receipt of the claim; and it should then be remitted to the following meeting for consideration. In the interval public notice should be drawn to the claim by advertisement in the *Journal*, setting forth succinctly the subject of such claim, together with the claimant's name and address.

4. On the establishment of a claim (on the conditions above specified) the Committee should make an award, which would not fall below £5 nor exceed £200. Between these limits the award should be fixed by the Inventions Committee, according to the opinion they may form of the value of the improvement for which the claim has been made. It is to be understood that any improvement which the Committee may not deem worthy of an award of the minimum of £5 shall be held invalid. If the Committee consider any invention put before them of superlative merit, and possessing advantages which they believe calculated to be of wide and valuable service to the gas industry, the maximum award of £200 shall be made, together with the taking out, at the Committee's expense, of patent rights in different countries, on behalf of the inventor; provided always that all the companies and corporations who contribute to the Inventions Fund (as per Rule 11) shall have, on paying a small royalty, to be fixed, the use of any such superlative invention so protected. But the inventor shall have the right to charge an increased royalty, or patent rights, to all users of his invention in the United Kingdom who do not contribute to the Inventions Fund; and also from all users of his invention in the different foreign countries in which patent rights have been secured.

5. When a manager or workman improves a machine or appliance either in principle or in detail of construction—which improves the efficiency of that machine, or lessens the cost of manufacturing new machines of a like character—in addition to his award from the general fund, the claimant shall receive from the trading engineer whose machine is so improved, a sum additional, equal to 50 per cent. upon the amount awarded by the Inventions Committee. But any invention upon a machine which has been anticipated by the maker of such machine, in manufacturing subsequent machines, shall not be held as a valid ground upon which to grant an award, provided the trading engineer concerned notifies to the Inventions Committee his priority in the improvement.

6. The subject of any claim shall be decided upon by the Inventions Committee with reference to the particular machine or system to which it primarily relates; but the adaptation of any contrivance connected with one machine to another which enhances the utility of the latter, shall be a valid ground for an award; provided the two machines or

appliances concerned are distinctly dissimilar in type, principle, or operation.

7. After the Inventions Committee have completed their consideration of a claim, the Secretary shall intimate their decision in the claimant, and advertise the result in the *Journal;* and, if it is favorable, enclose a check for the amount awarded, signed by the President and Secretary. When the invention improves the efficiency of any machine or appliance (as per Rule 6), he will also enclose a requisition to pay, signed by the President and Secretary, on the manufacturer of such machine or appliance, for the amount to which the claimant is entitled under the said rule.

8. Whenever any workman or manager has received as many as five awards, he shall be paid a premium equivalent to the total amount of money paid him for these five awards. For every succeeding five awards which he may earn, he shall be paid a similar premium; but with the addition of £100 in the case of the second set of five awards; of £200, in the case of the third set of five; and so on, £100 more by sets of five.

9. All claims for awards should be clearly set forth in writing and, when necessary, accompanied by a drawing or model, and to be forwarded to the Secretary under cover, marked "Inventions Committee."

10. The Secretary shall be required to attend all meetings of the Committee and keep a minute book of the proceedings. He shall also publish in the *Journal* the notice of the claim, and, when a decision is arrived at, give notice of the same to the claimant, and, when an award is granted, publish a concise specification of the invention in the *Journal.*

11. The funds to be collected on the following basis—

(*a*) Works carbonizing under 2,000 tons of coal per annum, to pay £10 yearly.

(*b*) Works carbonizing over 2,000 tons and under 6,000 tons, to pay £20 yearly.

(*c*) Works carbonizing over 6,000 tons and under 10,000 tons, to pay £40 yearly.

(*d*) Works carbonizing over 10,000 tons and under 20,000 tons, to pay £65 yearly.

(*e*) Works carbonizing over 20,000 tons and under 50,000 tons, to pay £100 yearly.

(*f*) Works carbonizing over 50,000 tons and under 100,000 tons, to pay £150 yearly.

(*g*) Works carbonizing over 100,000 tons and under 300,000 tons, to pay £200 yearly.

(*h*) Works carbonizing over 300,000 tons and under 600,000 tons, to pay £300 yearly.

(*i*) Works carbonizing over 600,000 tons to pay £500 yearly.

(*j*) Trading engineers shall pay £20 per annum to the general fund.

12. It shall be within the power of the Inventions Committee to offer a prize of such amount, and at such time, as they deem advisable for the invention or discovery of any specific principle or contrivance, upon which they might judge it desirable to concentrate the inventive faculty of all those engaged in gas making; and further, they may, in the same manner, offer a prize, under such restrictions as they may consider necessary, for the best essay on any subject relating to the trade.

I have thus put forward a scheme which, I believe, if adopted, subject to alteration by the Inventions Committee, will stimulate the invention of ingenious contrivances, tending to facilitate general operations, extend manufacturing skill and originate new and valuable principles in the manufacture of gas. This scheme would engender a healthy rivalry among the workmen, and cause them to exert themselves and expand their best faculties. The origin of competition is readily traceable to the institution of ownership; and the hope of being credited with and rewarded in this public way for inventing and improving machines, appliances and methods, would give competition among the men that stimulus which sharpens the human intellect and develops man's inventive powers to the utmost.

This struggle for success, which constitutes competition, is only an intensified form of emulation—one of the most deep-seated feelings in man's nature. Emulation is unquestionably one of the ruling forces of life; it is one of the mainsprings to human effort. Wherever this instinct is not either deadened or obliterated, it exerts a great influence on man's efforts. It is a force that exists for good or for evil, according to the purpose for which it is used; and I ask, Why should not this powerful lever be pressed into the service of gas making with all its force? This scheme, I believe, is well fitted for such a purpose. If we enlist the spirit of emulation among the men, and press it into the service of the great gas industry, we shall have taken a step which will do much to help the gas manufacturers of the United Kingdom—managers and workmen alike—to hold their own in the face of increasing competition.

Danger in the Grindstone.

According to a contemporary, it would be difficult to imagine a more harmless looking piece of mechanism than the ordinary shop grindstone, used for tool and miscellaneous grinding. Revolving as it does at a very moderate speed, and being free from any complication of parts in motion, there is no suggestion of the aggressively dangerous character which it possesses under certain not unusual conditions. Its proverbial propensity for "bursting" does not exist except at a high rotative speed, from which the centrifugal force is greater than the cohesive strength of the material, provided, of course, that the stone is not a defective one. As, however, a bursting speed would not be suitable for tool grinding, on account of the danger of burning the tool, the stone may be considered as perfectly safe in this respect. The element of danger referred to consists in having a rigidly fastened rest for supporting the work while grinding, a practice by no means uncommon, even in well regulated shops, and many a lost or maimed hand may be charged to its use.

In grinding lathe and planer tools, drills, chisels, etc., if it be properly done, the hands are unavoidably held close to the face of the stone. As it is very unusual to find a stone of perfectly uniform texture throughout, the softest parts will, naturally, wear more rapidly than the harder, and as a consequence the face is more or less out of true most of the time. Also, there are local defects, such as small holes, hard flinty spots and streaks. As a consequence of this uneven surface, it is very difficult to keep a hardened tool in contact with it, under sufficiently uniform pressure to insure good work, without more or less danger of its turning slightly in the hands and digging into the stone. This is always liable to happen, even with the most careful and skillful workman, and the majority are not, to say the least, careful. The result of this mishap is dangerous or harmless, according to the kind of rest with which the grindstone is furnished. If it be a fixed one, bolted firmly to the frame, the tool will bring up against it, and can only free itself by gouging a hole or groove in the stone. This, of course, takes considerable force, and if, as is usually the case, the workman's hands are between the tool and the rest, they must sustain the full pressure, unless withdrawn very quickly.

As the mishap and its effect take but an instant of time, there is very little chance to consider—the result is known very speedily. But while a pinch of this kind may be painful, it is not often very serious. The greatest danger from a fixed rest is in its not being kept in close adjustment to the face of the stone. After the latter is trued up and the rest set so as to just barely clear the stone, it is not often readjusted until the space, as increased by the wear from use, is so great as to become inconvenient. If, for instance, there should be a gap of about ¼ inch, and the tool catch as described, the usual result would be that the tool would be carried down and jammed fast—either stopping the stone by throwing the belt, or splitting a piece out of the stone, possibly destroying it entirely. But the most serious danger would be to the hands of the workman, which might also be drawn into the narrow space, with the result of being mangled and perhaps permanently maimed.

Usually an accident of this kind is attributed to carelessness—which it undoubtedly is, but far more on the part of the shop management, which permitted the use of so unnecessarily dangerous a contrivance, than that of the unfortunate victim. The use of this rest is the less excusable as it does not even possess the merit of being better, in any respect, than one which would be perfectly safe. There is nothing better for a rest for hand grinding than a simple piece of 3 by 4 inch scantling laid across the frame, without fastening of any kind whatever. If a tool catches, the worst that can happen may be some skin ground from the workman's knuckles—there is no mangling. Of course reference is made to the proper method of using the stone—that is, grinding on the side running down, so that the stone runs toward the work, and not from it, as it would on the opposite side.

The Improved Peebles Gas Governor.

Mr. David Bruce Peebles, of Edinburgh, has recently applied for English Letters Patent on an improved form of gas governor, the main principles of which are clearly outlined in the following abstract from the filed specification:

The object of the inventor is to improve gas governors, so as to make them more efficient and less liable to get out of order. There are sev-

eral forms of the governor—suitable for large and small gas supplies, upward and downward supplies, and for insertion in a single burner. In one form, designed for the regulation of a large flow of gas, the regulator case is of a well known kind, the novelty lying in the construction of the valve. This valve is shaped like the segment of a sphere, and is made very thin for lightness. The shape gives the valve disc strength; and it is further strengthened by a saucer-shaped disc upon its under and concave side. This valve works in a cylindrical guide which rises from the dividing wall of the valve casing; and at the bottom of the guide there is a bevelled seat, upon which the valve rests when fully closed. In the sides of the guide are formed a number of curved openings, the lower ends of these openings being pointed. It will be understood that it is the rise and fall of the valve disc in this guide—increasing or reducing the area of the openings—that effects the regulation.

A supplementary device is attached to this valve for effecting regulation when only a few of the burners supplied through the governor are in use, and thus preventing the fluctuations which usually occur with large governors in such circumstances. Upon a bridge depending from the dividing wall of the valve casing there is supported a small cylinder, and in this cylinder a piston, fixed to the lower end of the valve spindle, works. In the sides of the cylinder (near the lower end) are formed openings with pointed lower ends. The portion of the valve spindle below the main valve is hollow, and just above the main valve there is a small hole in the spindle. When a few burners are turned on the pressure above the valve is reduced a little, but not sufficient to cause the main valve to open; therefore the supply is effected by means of the supplementary valve—the gas passing through the openings in the cylinder (now partially opened by the rise of the piston in the cylinder), up through the hollow valve spindle and out through the little hole above the main valve.

In a modification of this governor the valve opens downwards, its upward motions being effected by a floating bell arranged in a small tank formed on the top of the valve casing, and containing water or other suitable liquid. The valve in this case takes the form of a hollow cone; but all the other parts are practically the same as already described, only inverted, with the exception that the openings in the cylinder of the supplementary valve are not regulated by a piston, but by the main valve. The top of the cylinder passes through the bottom of the conical main valve; and as the main valve descends, in response to a small demand for gas, the openings in the small cylinder are opened, gas enters the interior of the conical valve through a small hole formed near the top of the valve, through the uncovered openings, and through the cylinder to the outlet.

The third modification is for small governors, and here there are described means for obtaining the effective regulating action which the area of the valve itself is too small to give. In a regulator suitable for a downward supply, the inlet chamber has within it a cylindrical chamber, formed in the top of the block in which the valve passages are cut, and closed at the top. From the inlet chamber the gas finds its way by the annular space between the two chambers to a transverse passage formed below the inner chamber. The transverse passage communicates by an opening with the inner chamber, and the area of this opening is controlled by the valve, which takes the form of a cylindrical plug working in a bore in the bottom of the regulator body. Within the inner chamber there is accurately fitted, but without frictional tightness, a disc, and this disc is connected to the valve by means of a tubular spindle. The gas, entering from the transverse passage, acts upon the under surface of this disc, and turns downwards through another passage to the outlet. The free way of this latter passage is controlled by means of a screw. The outlet pressure is conveyed to the upper surface of the disc through the tubular connection between the valve and the disc.

A modification of this, designed for an upward flow of gas, is described. The gas passes into a central vertical bore or passage, closed at the bottom, and at the top opening under the regulating disc. From under the disc the gas passes down one passage, through a cross connecting passage, and up a tube which passes through the disc and reaches to near the top of the outlet chamber. The regulation is here effected by the valve (which works within the central bore or passage) increasing or decreasing the area of the ports into that passage. The form adopted as a burner governor is substantially that just described; and it is enclosed in a conical shell, in the apex of which the valve spindle is guided. Instead of a lateral screw regulating the quantity of gas, this is done by means of a small disc placed upon the valve spindle above the governing disc. In the governing disc there are openings made; and the regulation is effected by varying the distance between the two discs.

The Utilization of Niagara.

Prof. W. C. Unwin, F. R. S., in the course of his opening address before the Mechanical Science Section of the British Association, made the following interesting references to the proposed utilization of the waters of Niagara Falls:

Few persons can have seen Niagara Falls without reflecting on the enormous energy which is there continuously expended, and for any useful purpose wasted. The exceptional constancy of the volume of flow, the invariability of the levels, the depth of the plunge over the escarpment, the solid character of the the rocks, all mark out Niagara as an ideally perfect water-power station, while, on the other hand, the remarkable facilities of transport, both by steam navigation on the lakes, and by four systems of railway, afford commercial advantages of the highest importance. From a catchment basin of 240,000 square miles, an area greater than that of France, a volume of water amounting to 265,000 cubic feet per second descends from Lake Erie to Lake Ontario, a vertical distance of 326 feet, in 37½ miles.

Supposing the whole stream could be utilized, it would supply 7,000,000 horse-power. This is more than double the total steam and water power at present employed in manufacturing industry in the United States.

Immediately below the Falls the river bends at right angles, and flows through a narrow gorge. The town of Niagara Falls on the American side occupies the table-land in this angle.

The earliest traders who settled near the Falls erected stream mills in the Upper River in 1725, for preparing timber. Later, the Porter family erected factories on the islands in the rapids above the Falls. It was not, however, till about thirty years ago that any systematic attempt was made to utilize part of the water-power of the Falls. Then a canal was constructed from Fort Day, about three quarters of a mile above the Falls, to a forebay or head-race along the cliff overlooking the lower river. In 1874 the Cataract Mill was established, taking power from this canal, and other mills were gradually erected till about 6,000 horse-power was utilized. These mills have been exceedingly prosperous, but since the growth of a feeling against the disfigurement of the Falls, it has become impossible to extend works of the same kind.

The idea of a method of utilizing the Falls, capable of greater development, and free from the objections to the hydraulic canal with mills discharging tail water on the face of the cliff, is due to the late Mr. Thomas Evershed, Division Engineeer of the New York State Canals. He proposed to construct head-race canals on unoccupied land some two miles above the Falls. From these the water was to fall through vertical turbine pits into tail-race tunnels, converging into a great main tunnel, discharging into the lower river. Apart from an inappreciable diminution of the volume of flow over the Falls, this plan avoids any disfigurement of the scenery near the Falls, and permits a head of nearly 200 feet to be made available. It is, however, essential to such a plan that work should be undertaken on a very large scale. In 1886, the Niagara Falls Company was incorporated, and obtained options over a considerable area of land, extending from Port Day for two miles along the Niagara River. In 1889, the Cataract Construction Company was formed to mature and carry out the constructional works required.

The present plans contemplate the utilization of 100,000 effective horse-power. The principal work of construction is a great tunnel 7,250 feet long, which is to form a tail-race to the turbines, starting from land belonging to the company and discharging into the lower river. The tunnel is 19 feet by 21 feet, or 386 square feet in area, inside a brickwork lining 16 inches thick.

The base of the tunnel is 205 feet below the sill of the head gate, and permits a fall of 140 to be rendered available at the turbines. The brickwork of the tunnel is lined for 200 feet from the mouth with cast-iron plates.

The tunnel has been excavated with remarkable rapidity with the aid of drills worked by compressed air.

The main head-race, about 200 feet wide, will run for about 5,000 feet parallel with the river, having entrances from the river at both ends. Near this lower reach the Soo Paper Company is already arranging to utilize 6,000 horse-power, discharging the water from the turbines through a lateral tunnel into the main tunnel. Near this lower reach will also be placed two principal power stations, from which will be distributed, either electrically or otherwise in ways not yet fully determined. The first turbines to be erected in these power stations will be twin turbines of the outward flow type of 5,000 effective horse-power. These turbines have a vertical shaft for driving dynamos or other machinery placed above ground.

According to Mr. Evershed's original plans, it was intended to distribute water by surface canals to different power users, each of whom would sink his own turbine pits, connected below by lateral tunnels to the main discharge tunnel. Some of the power at Niagara will undoubtedly be used in this way, and in the case of industries requiring a large amount of power, it will be economical to purchase a site and water rights.

Such a plan is, however, not adapted to smaller factories. Obviously for them it would be more economical to develop the power in one or more central stations by turbines of large size under common management. Further, once given the means of distributing power instead of water, an important extension of the project becomes possible.

Besides supplying power to industries which may locate themselves at Niagara, the power may be transmitted to the existing factories in Buffalo and Tonawanda.

Arrangements are already proceeding to transmit 3,000 horse-power to Buffalo, a distance of 18 miles, to work an electric lighting station.

In 1890, Mr. Adams, the President of the Niagara Construction Company, visited Europe to examine systems of power distribution. It was in consequence of this visit that the important modifications of the plans of the company involved in the substitution, to a large extent, of a system of power distribution for a system of water distribution came to be adopted. The American engineers were anxious to obtain the best European advice as to the methods best suited to the local conditions. A commission was formed, consisting of Lord Kelvin, Dr. Coleman Sellers, Professor Mascart, and Colonel Turrettini, and an invitation was given to engineers and engineering firms in Europe and America to send in competitive projects for the utilization of the power at Niagara and its distribution to different consumers at Niagara and in Buffalo by electrical or other means. Many of the plans sent in were worked out with great care and completeness. As to the hydraulic parts of the projects, there was some approach to general consent as to the arrangements to be adopted, but as to the methods of distributing the power there was an extraordinary diversity.

Generally the Commission reported in favor of electrical distribution, with perhaps a partial use of compressed air as an auxiliary method.

Generally also they reported in favor of methods of distribution by continuous currents in preference to alternating currents. Since the date at which the Commission reported, the Frankfort-Lauffen experiment has been made, and in the opinion of some electrical engineers a distinct advance has been achieved in the use of alternating currents at high potential.

The company has not yet decided to adopt any plan for the central stations except in a tentative way. One or more turbines of 5,000 horse-power are to be erected, and probably at first this power will be distributed to Buffalo by an alternating current system.

The cost of a steam horse-power at Buffalo is reckoned at $35 per annum. I believe the company will be able to deliver power at from $10 for large amounts and a greater price for small amounts, this price being reckoned for twenty-four hour days.

The new industry of electric lighting has made necessary the provision of large amounts of motive power. Electric traction similarly depends on the supply of motive power. New chemical and metallurgical processes are being introduced which entirely depend for their commercial success on the supply of motive power at a low price.

Niagara is likely to become not only a seat of large manufacturing operations of familiar types, but also the home of important new industries.

Care of Tools.

A contemporary having remarked that the wooden parts of tools, such as the stocks of planes and handles of chisels, are often made to take on a nice appearance by the aid of French polishing, which adds nothing to their durability, goes on to say that a much better plan is to let them soak in linseed oil for a week, and rub them with a cloth for a few minutes every day for a week or two. This produces a beautiful surface, and at the same time exerts a solidifying and preserving action on the wood.

The following recipes, compiled by *The Tradesman*, are recommended for preventing rust on iron and steel surfaces:

1. Caoutchouc oil is said to have proved efficient in preventing rust, and to have been adopted by the German army. It only requires to be spread with a piece of flannel in a very thin layer over the metallic surface, and allowed to dry up. Such a coating will afford security against all atmospheric influences, and will not show any cracks under the microscope after a year's standing. To remove it the article has simply to be treated with caoutchouc oil again and washed again after 12 to 24 hours.

2. A solution of india-rubber in benzine has been used for years as a coating for steel, iron, and lead, and has been found a simple means of keeping them from oxidizing. It can be easily applied with a brush, and is easily rubbed off. It should be made about the consistency of cream.

3. All steel articles can be perfectly preserved from rust by putting a lump of freshly burnt lime in the drawer or case in which they are kept. If the things are to be moved—as a gun in its case, for instance—put the lime in a muslin bag. This is especially valuable for specimens of iron when fractured, for in a moderately dry place the lime will not want renewing for many years, as it is capable of absorbing a large amount of moisture. Articles in use should be placed in a box nearly filled with thoroughly slacked lime. Before using them rub well with a woolen cloth.

The following mixture forms an excellent brown coating for preventing iron and steel from rust: Dissolve 2 parts of crystallized iron chloride, 2 antimony chloride, and 1 tannin in 4 of water, and apply with sponge or rag and let dry. Then another coat of paint is applied, and again another if necessary, until the color becomes as dark as desired. When dry it is washed with water, allowed to dry again, and the surface polished with boiled linseed oil. The antimony chloride must be as nearly neutral as possible.

5. To keep tools from rusting, take half an ounce of camphor, dissolve in one pound melted lard; take off the scum, and mix in as much fine black lead (graphite) as will give it an iron color. Clean the tools and smear with this mixture. After 24 hours rub clean with a soft linen cloth. The tools will keep clean for months under ordinary circumstances.

6. Put one quart freshly slacked lime, half pound of washing soda, and half pound soft soap in a bucket and sufficient water to cover the articles; put in the tools as soon as possible after use, and wipe them up next morning, or let them remain until wanted.

7. Soft soap, with half its weight in pearlash, one ounce of mixture in about one gallon boiling water, is in everyday use in most engineer's shops in the drip cans used for turning long articles brought in wrought iron and steel. The work, though constantly moist, does not rust, and bright nuts are immersed in it for days until wanted, and retain their polish.

8. Mix slowly together 6 ounces or 8 ounces lard to 1 ounce resin, stirring till cool; when it is semi-fluid it is ready for use. If too thick it may be further let down with coal oil or benzine. Rubbed on bright surfaces ever so thinly, it preserves the polish effectually, and may be readily rubbed off.

9. To protect metal from oxidation—polished iron or steel, for instance—the requisite is to exclude air and moisture from the actual metallic surface; therefore polished tools are usually kept in wrappings of oil cloth and brown paper, and thus protected they will preserve a spotless face for an unlimited time. When these metals come to be of necessity exposed in being converted to use, it is necessary to protect them by means of some permanent dressing, and boiled linseed, which proves a lasting covering, as it dries on, is one of the best preservatives, if not the best. But in order to give it body it should be thickened by the addition of some pigment, and the very best, because the most congenial of pigments, is the ground oxide of the same metal, or, in plain words, rusted iron reduced to an impalpable powder, for the dressing of iron and steel, which thus forms the pigment or oxide paint.

10. Slack a piece of quicklime with just enough water to cause it to crumble in a covered pot, and while hot add tallow to it and work into paste; and use this to cover over bright work. It can be easily wiped off.

11. Olmstead's varnish is made by melting 2 ounces resin in 1 pound fresh, sweet lard, melting the resin first. and then adding the lard and mixing thoroughly. This is applied to the metal, which should be warm, if possible, and perfectly cleaned; it is afterward rubbed off. This has been well proved and tested for many years, and is particularly well suited for planished and Russian iron surfaces, which a slight rust is apt to injure very seriously.

Rust Removers.—1. Cover the metal with sweet oil, well rubbed in, and allow to stand for 48 hours; smear with oil applied freely with a feather or piece of cotton wool after rubbing the steel. Then rub with unslacked lime reduced to as fine a powder as possible.

2. Immerse the article to be cleaned for a few minutes, until all the dirt and rust are taken off, in a strong solution of potassium cyanide—say about one half ounce in a wineglassful of water; take it out and clean it with a toothbrush with some paste composed of potassium cyanide, castile soap, whiting and water mixed into a paste of about the consistency of thick cream.

An Ether-Oxygen Lantern.

The following description of a new form of lantern, which has been patented in this country and Europe, may be of interest to our readers:

The oxygen is generated while the lantern is in operation, and part of it is passed through an ether saturator. The same idea, says the *Photographic News*, was long ago carried out in Mr. Chadwick's tank apparatus. It certainly seems a retrograde step to procure oxygen in this fashion, with its risks and other disadvantages, when it can be obtained ready made so much more conveniently, and, we may add, at a cheaper rate. The matter was recently brought before the Royal Society of Canada by the inventor, Mr. G. R. Prowse, of Montreal, and the following is an abstract from his paper :

The apparatus has been designated the ethoxycon, as indicating the use of ether and oxygen. It combines both the lantern proper and the gas generator and storage bag or receiver. In general terms, the generating and storage parts consist of a generator or retort for the production of oxygen gas, a filter or washer, a saturator, a regulator and a storage gas receiver. All of these, together with the lantern proper, are contained in a box or case which measures 10 by 18 by 18 inches. This also serves as a stand for the lantern when in use. The details of construction and operation are as follows :

The lantern proper, or the optical part of the instrument, consists of the ordinary lens system for enlarging, projecting and focussing the image of the object as illuminated by rays of light passing through a condenser. The gas generator consists of an iron or steel tube with a semi-circular cross section. Into the flat or lower side are inserted a number of copper cups, each of a capacity to contain sufficient mixture to maintain the light for about 15 minutes. The different rates of conduction in the two metals of the retort serve two purposes. The copper, being a rapid conductor, brings about a speedy fusion of the chlorate of potash, which quickly gives off gas. The iron, by its slower conductivity, serves to retard the transmission of heat from cup to cup, thereby prevents action taking place in any cup not directly heated, and secures complete control of the whole operation. Each cup is heated in turn by means of a spirit lamp or a small Bunsen burner, as may be desired, the transfer of heat from one to the other being effected automatically by an attachment which is operated by the receiver when the gas has reached a certain degree of exhaustion. The washer, saturator and regulator are combined in one piece, measuring 7.5 by 12.5 by 30.5 cm. This is placed directly beneath the body of the lantern, between the triangular supports. The central longitudinal section is occupied by the washer. This consists of a tube arranged with fine wire cloth, and filled with a moist filtering substance, which serves to arrest any particles of carbon (*sic*) or other similar impurities which may pass over from the retort. On each side of the washer is a similar tube filled with pin wood sawdust, which is charged with sulphuric or petrolic ether, as may be desired. The form of saturator is an improvement upon that usually employed, while the construction is such as to avoid all possibility of explosion. Towards one end, and directly over the washer, is a small stand-pipe, with two stopcocks and a regulator. The latter consists of a rubber diaphragm, upon which rests a lead disc weighing about 136 grammes. The amount of gas passing through from the regulator to the burner is determined by the adjustment of two needle-point valves, one for each gas, and thus the production of a brilliant light is readily secured.

The gas receiver is contained in the case, which holds the entire instrument when in transport. It consists of a rubber bag, having a capacity of nearly one foot, the upper part of which is formed of a tin pan working upon two upright metal posts, one of which serves as a tube for the conveyance of gas to and from the receiver. Into the pan there is loosely fitted a second pan, designed to be filled with water in order to establish the necessary pressure. Upon the front edge of the first pan are a number of catches designed to engage a spring and automatically transfer the source of heat from cup to cup as the pan descends during the exhaustion of the contained gas.

Black oxide of manganese (MnO_2) and chlorate of potash ($KClO_3$) in the proportions of 1 : 3 are now thoroughly crushed and mixed. If the crystals of chlorate are fine, thorough mixing with a spoon will suffice, but if large it will probably be found better and more expeditious to pass the mixture through an ordinary coffee mill. A metal trough of the form and length of the retort is now filled with the mixture, passed into the inverted retort, the whole reversed, and the charger or trough withdrawn. In this process each cup will be filled, and any excess of material discharged as the trough is drawn out. The head of the retort is next firmly clamped on, the retort is placed in position on its supports, and the lamp adjusted to the first cup on the right. A large rubber tube is now connected with the retort at one end and with the washer at the other, while the small tube leading from the receiver is also attached to the washer. After making certain that all connections are perfectly tight, heat is applied. If sufficient, gas will form in 2½ minutes, the first indications of which will be in a slight action of the receiver, followed by an elevation of the regulator to its full height. The pan now rises rapidly, and, under favorable conditions, the light should be on the screen within five minutes from the first application of heat to the retort. When alcohol is used in generating the gas a somewhat longer time must be allowed for. The distribution of the gas takes place in the following manner :—As fast as it generates it passes from the retort to the washer, whence it returns by a small tube to the receiver, in which the surplus is stored. From the washer it also enters the standpipe and regulator, which latter determines a uniform pressure in the gas supplied to the jet, thereby securing a steady light. From this point as regulated by the needle valves, the gas is led by two separate channels to the point of consumption. One valve transmits pure oxygen directly from the washer. The other causes a certain volume of oxygen to pass downward into one of the saturators, from which it passes into the second, and thence directly to the burner. In its course it becomes supersaturated with ether, and, therefore, constitutes the substitute for the ordinary hydrogen gas employed where separate gases are used.

The capacity of the retort is such that sufficient gas may be generated to operate the light continuously for about two hours. Two or more retorts will be found of advantage, and by their use continuous service may be secured for any length of time.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Captain W. H. Miller, Asst. Quartermaster, U. S. A., advertises that proposals for enlarging the gas works at the West Point Military Academy will be received up to noon, of Monday next, bids to be made in accordance with a set of general conditions, a printed copy of which can be obtained by addressing Captain Miller, at West Point, N. Y. The general plan of enlargement calls for a completed plant equal to the putting out of 125,000 cubic feet per day, an enlargement that will necessitate a new holder of at least 50,000 capacity, condenser, washer, scrubber, purifiers, meter, boiler, exhauster, etc. The addition is to be carried out without any interruption to the supply of gas from the existing plant, and contractors are further notified that their bids, in respect to labor, must be based strictly on the recent enactment, which provides that "The service and employment of all laborers and mechanics by the Government of the United States, or by any contractor or sub-contractor, upon any public work of the United States * * * is limited and restricted to eight hours in any one calendar day, and it is unlawful for any officer of the United States, or any such contractor or sub-contractor to require or permit any such laborer or mechanic to work more than eight hours in any calendar day, except in case of extraordinary emergency."

We are indebted to "Port Hope" for the following, from the Montreal *Star*, which explains itself : "A lawsuit of a very interesting nature has been entered by Col. F. D. Leys against Mr. William Duffield, Sr., on behalf of the stockholders of the London Gas Light Company and the City Gas Company, of London, Ontario. Early in the '80's, Mr. William Duffield started an opposition Company in London, but the venture proved an absolute failure, although, at the same time, the interests of the old Company were injuriously affected. Some of the leading parties in the old Company sought an amalgamation with the Duffield Company, and in 1883 they succeeded, by means of a concealed bond, given by Duffield to them for the payment of a certain amount annually—the fact of the existence of the bond was not disclosed to any of the stockholders. Mr. Duffield gave $120,000 of unissued stock to the old Company, which they paid up and gave to Mr. Duffield for his plant. The great consideration, however, is said to have been in the condition contained in the concealed bond. Mr. Duffield, who secured five shares, in addition to the 1,200 shares, giving him a controlling interest of $120,500 in a capital stock of $240,000, has, with Messrs. J. F. and W. A. Duffield, voted himself $6,000 a year, in addition to drawing an annual dividend of $9,600. It is only recently that the particulars of the bond have been discovered, and some of the stockholders are desirous of having the Duffield bond cancelled, because they assert he gave no consideration therefor. It is expected that the case will be tried at the autumn sitting of the Court of Chancery of the Assizes."

The proprietors of the Lynn (Mass.) Gas and Electric Company have entered into a contract with the authorities of the adjoining hamlet of

Saugus for the public lighting of that place. The contract for five years.

MR. GEORGE F. MACMUN, formerly in charge of the Natick (Mass.) works, is now in command of affairs at Marlboro, Mass.

GOVERNOR RUSSELL has named Mr. James W. McDonald, the newly appointed member of the Massachussetts Board of Gas and Electric Light Commissioners, to be President of that body. We hoped that Commissioner Barker would have been named for Chairman, but we make no doubt that Mr. McDonald will fill the bill acceptably. He is said to be a very capable and fair minded man.

LEWISTON, Idaho, wants electric lights, and the Lewiston Water and Light Company offers to furnish the same at the rate of $13.50 per lamp per month.

THE Elmira (N.Y.) Electric Illuminating Company is building a new plant, and has placed a contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for the roofs of the structures, which are to be of iron. The dynamo room will be 66 feet wide by 177 feet long, and is to be covered with the Berlin Company's patent anti-condensation corrugated iron roofing. The floor space will be controlled by a 10-ton travelling crane. The boiler room will adjoin the dynamo room and will be 32 feet wide by 75 feet long. When completed it is believed that Elmira will have one of the finest electric light plants in this State.

A CORRESPONDENT at Vallejo, Cal., writing under date of August 30, says: "Sheriff Henderson has attached the franchise of the local electric light company, and is now operating the plant. The authority under which he acts is an attachment issued out of a suit brought by John Maguire against the company for the sum of $10,384. As complainant is Vice-President of the company, the suit is somewhat mystifying, and there are those who do not believe there is any genuine legal fire in the contest. He, however, claims to have advanced the sum of $10,384 to the company, and other officials of the concern reply that it does not owe him a cent. In any event, the Sheriff is in charge. The company has had a very hard time of it from the start, and if it now can do nothing better than sue itself, it is difficult to note who is to make any money out of its existence, save the lawyers."

AT the annual meeting of the shareholders in the Port Townsend (Wash.) Gas Company, the following result was reached: Trustees, David Humphrey, of Tacoma, and John Lillie and Israel Katz, of Port Townsend; President, David Humphrey; Vice-President, Israel Katz; Secretary and Treasurer, John Lillie.

THE proprietors of the Malden and Melrose (Mass.) Gas Company have extended the mains to the adjoining hamlet known as Baker's Hill, where a number of gas consumers have already been secured.

THE Seattle (Wash.) *Post-Intelligencer*, of August 24, says: "The new owners of the Seattle Gas, Electric Light and Motor Company have assumed the management and taken charge of the property. At a meeting of the shareholders the following Trustees were elected: Hon. Henry G. Struve, Col. G. M. Nelson and Messrs. John Mather, R. C. Elliot and L. Turner. These Trustees then elected the following officers: President, Hon. H. G. Struve; Vice-President and General Manager, John Mather; Secretary and Treasurer, L. Turner. Mr. Mather (who was General Manager of the West Superior, Wis., Water, Light and Power Company), on assuming charge of Seattle works, spoke as follows respecting the plans of the new management: 'We intend to extend the gas mains to any part of the city where there is any call for them, and shall do all in our power to make the Gas Company a popular institution. The Company now has 18 miles of mains and a plant with a capacity of 400,000 cubic feet a day, which is enough to supply the whole city. We shall make a great effort to introduce the use of gas stoves here, and shall sell gas at reduced prices for fuel, so that the people generally can use these stoves. People who have once got into the habit of using gas stoves never return to coal for fuel. In some cities as much gas is used in the daytime as in the night. We shall maintain the current price of gas for lighting for the present. We shall also extend our electric plant. We now have only an arc light plant, but we intend to go into the incandescent lighting business as well. No changes will be made in the works or in the process of manufacture; there are improved processes which cheapen the manufacture, but we cannot introduce them immediately. No changes will be made among the employees, except that Captain N. Penfield retires from the management.' Mr. Mather has had seven years' experience in the gas and electric business, and is a keen, wide awake business man. After closing his business at West Superior he came to this city to make his permanent residence here."

OUR brief announcement in last issue, respecting the damage to the Donnison, Texas, plant by fire (on the evening of August 26th), is supplemented by the following details of the unfortunate happening. The flames broke out in the new wing of the works on Morgan street—the enclosing structure was of frame—and before the fire was extinguished damage to the amount of perhaps $4,000 was sustained. The losses were pretty well covered by insurance, and there was no interruption to the gas supply.

THE new and handsome plant of the Manhattan Fire Brick and Enamelled Clay Retort Works, at Perth Amboy, N. J., was put in action on Wednesday last, and hereafter the old plant at 15th street and Avenue C, this city, from whose ample resources many a retort house in this country derived its equipment, will shut down. An office will be retained on the old site. May the Messrs. Weber have as good fortune at the new stand as was their portion at the old.

THE Consolidated Gas and Electric Light Company, of Rye and Portchester, N. Y., has suffered much loss of late by the destruction, willful and malicious, of many of its handsome street lamp globes. In fact, the Company has been obliged to offer a standing reward for the detection of the offenders, who should long ago have been apprehended and punished by the local authorities. Of course, it is needless to add that the Company annually pays into the town treasury a good round sum, a portion of which, it is presumed, goes towards paying the expenses of the local policing.

SOME time ago we noted the formation of a lighting enterprise at Crookston, Minn., and to that mention we add the following. The Company is to be known as the Crookston Gas and Lighting Company, and its officers are: President, Hon. Hugh Thompson; Vice-President, William Anglin—Mayor of the City; Secretary, C. E. Sawyer—cashier of the local First National Bank; Treasurer, L. D. Marshall.

AN interesting observation respecting the deterioration of asphalt pavements by escaping illuminating gas is reported from Germany, where, at Frankfort-on-the-Main, asphalt roads that were put down in 1885–86, were shown to be much changed some two years later—1888. Cracks were observed, about 1 inch wide, quite similar to those in a dry field. In the interior the asphalt had become transformed into a tarry mass, which gave off the odor of illuminating gas. That the escaping gas was largely responsible for the changes in the roadbed would seem to be so from the fact that the alterations were almost altogether above the line of the gas mains. On taking up the pavement fissures were found in the concrete underneath, which permitted the gas to reach the asphalt. The carbo-hydrates were absorbed, principally the benzine. The asphalt became pasty and lost its cohesion.

MR. J. E. ADDICKS, who reports himself to the court as from Claymont, Del., has filed a petition in the court of insolvency, for Suffolk county, Mass., praying that a warrant may issue to take possession of the property of the Suburban Light and Power Company, of Boston, and cause a distribution of the same amongst the Company's creditors. The Company was organized with a capital of $75,000, and has done only a small business in the district of Roxbury and vicinity.

THE official gas inspector at Detroit, Mich., asks that his salary be increased, on the ground that his office is not in any sense the place of a sinecurist. In fact, he (Mr. Walter B. Cole) complains that the place requires "a good deal of time, as much, in fact, as any appointment."

A CORRESPONDENT forwards the following from Minneapolis, Minn., respecting some recent doings of the Gas Committee of the Common Council: "The use of the big electric light mast to illuminate the City Hall will be discontinued. That was about the extent of the work done at a long session of the Council Committee on Gas, held towards the close of August. The Committee was unanimous, however, in the belief that the eight lamps which now hang half-way up the iron pole would be of more utility if distributed about the neighboring street corners at the height at which such lamps are usually placed. The Committee had a long discussion over the matter of extending the present lighting hours to the number of lamps provided for in the new specifications and contracts, but adjourned without taking definite action. Light Inspector Meloy submitted a report naming the location of 175 lamps already ordered, and 400 new ones, which, with the 3,122 now burning make a total of 3,697 and leave a margin of 303 to meet future

demands before the limit of 4,000 on the contract is reached. Among other localities the new lamps cover the district north of Western avenue to the railroad tracks, between Linden and Chestnut avenues, 7th and 8th avenues, south of 10th street, Sunnyside, Washington and University avenues, southeast. If the moonlight schedule is adopted the figures will look like this—

600 electric lights, at $125	$75,000
4,000 gas lamps, at $15.63	62,520
2,496 gasoline lamps, reduced to 1,200, at $14.40	17,280
	$154,800

The all-night schedule figures up this way—

600 electric lamps, at $150	$90,000
4,000 gas lamps, at $26.79	107,160
	$197,160

This last account or estimate does not include anything for gasoline lamps. It has been assumed by the Committee in its estimates that $190,000 will be about the limit which the Ways and Means Committee will appropriate, and this would seem to preclude the possibility of more than a partial adoption of the all-night schedule in street lighting, at least until some system of retrenchment can be enforced in other departments."

"OBSERVER" informs us that Henry Hall, the absconding employee of the Brookline (Mass.) Gas Light Company, was apprehended at Albany, N. Y., about a week ago. Hall, who is about 20 years of age, is under an indictment of embezzlement from the Company. He was employed in the Beacon street office, as an assistant cashier, and, in the absence of Treasurer Stearns, handled the money paid in over the counter. Implicit trust was placed in Hall, until shortly after he started on his vacation about a month ago, when an accountant discovered an entry that looked to be fraudulent. An examination of the books showed a shortage of $315, hence the indictment and arrest. Hall came to the Company from Toronto, Ont.

HABERMELL & SON, florists of Philadelphia, whose hothouses are at 22d and Diamond streets, have entered suit against the city for damages in the sum of $2,000. Having observed an unusual mortality amongst their rose bushes, an investigation disclosed the fact that the roses were fading because of an escape of illuminating gas from a main running through Diamond street.

WE regret to report the death, at the Kensington Hotel, Saratoga, N. Y., on the morning of Septemper 3d, of Capt. James R. Miller, President of the Pulaski Gas Light Company, of Little Rock, Ark. The following short sketch of his eventful life will be read with interest: "Jas. R. Miller was born at Rogersville, Tenn., in May 1834, and was one of the best known and most public-spirited men in the South, as well as one of the wealthiest. He has been the lessee of the labor from the Arkansas Penitentiary for the last seven years, and was, until 1891, sole owner of the Little Rock Street Railway. He had underway a number of fine business structures in Little Rock, several of which are just receiving their finishing touches. He started life as a printer's apprentice, and served as a compositor on the Louisville *Courier-Journal*, the Cincinnati *Enquirer* and the Nashville *American*. At the breaking out of the War of the Rebellion, he cast his lot with the Confederates, and when peace was declared he possessed the title of ex-Captain —and not much else. He subsequently became connected with the capitalists who scented fortunes in the manipulation of cotton seed, and in 1870 had amassed sufficient capital to construct, and operate on his own account, the Little Rock Oil Mills. He was also largely interested in mills of this type in several Southern States. Besides being President of the Pulaski Gas Light Company, he was President of the Arkansas Industrial Association, Director of the Arkansas Pipe and Pump Company, Director of the American Cottonseed Oil Mills, and a Director in the German National Bank and the Arkansas Insurance Company. He leaves a wife and four children."

MR. WILLETS SHERMAN has been appointed Superintendent of the Portage City (Wis.) American Gas Company. He is young and energetic, and has been in the American Company's service for some time, having received his first training under the direction of Mr. Fitz, who manages the American Company's branch, at Elgin, Ills.

UNCLE JERRY seems to be bent on keeping things going at Galena, despite floods or hurricanes, as witness the following mention from the Galena *Gazette*: "Ever since Mr. Howard took possession of the gas works at the commencement of the year, he has been busy improving the plant. He commenced down at the plant proper, where many changes and improvements were found necessary. On the East Side, in the vicinity of the shoe factory and water works, some of the supply pipes had rusted through in places, letting the water into the mains and checking the supply of gas. After considerable expense and patient work, putting in new pipes, the leaks have all been stopped. All the street burners were found to be placed too high in the lamps, and these have been cut down from 3 to 4 inches, so that now the burners stand in the center of the lamps, and thus throw a better light. All the lamp posts have been straightened, and the plant, as a whole, was never before in such good condition as now, nevertheless still further improvements will be made. Mr. Howard knows all about the gas business and he has the energy and push to put things in proper shape."

A HINT from Connecticut is to the effect that the new office building for the Derby Gas Company, of Birmingham, Conn., will be of the first order. The offices of the Company on the first floor will be well lighted and finished up in first-class shape. The Directors room and the show room at the rear of the building will also be neatly fitted up. On the second floor offices are being put in and rooms for the use of the Gas Company will also be especially prepared. On the third floor the Crescent Cycle Club will have its rooms and these are going to be very fine ones. At the front of the building will be the reception room, divided by an arch and running along the side will be the billiard room, while at the rear will be the card room. The closets and bath rooms will lead off from the billiard room. The approach to the rooms is a very easy one. The first flight of stairs rises direct from the street door to the foot of the stairs leading to third floor. The second stairway makes three turns before reaching the third floor and makes a very pretty flight. They are wide. The building is fitted throughout for gas and electricity and will be heated by hot water.

THE following is an abstract of the agreement relating to the lighting of the City of Concord, N. H., by the Concord Land and Water Power Company:

The party of the first part (the Power Company) agrees to furnish the party of the second part (the City), for a period of 10 years from July 1, 1892, at suitable points in the streets of Concord, south of the cemetery at West Concord, to be designated by the city government, electric arc lights for lighting purposes, and furnish power and lights for the same in the manner following, that is to say: Said party of the first part agrees to furnish 65 of said lights within 60 days from the execution of this contract at suitable places in the central wards of said city, to be designated by the city government, and on and after the completion of the dam at Sewall's Falls, belonging to said party of the first part, and the installation of its electrieal apparatus, and no later than March 1, 1893, to furnish as many additional lights of the same capacity and at such points as the city government may desire, at the rate of $50 each per year, payable quarterly.

Said party of the first part further agrees that during the continuance of this contract its prices for lighting and power to individuals and citizens shall not be greater than those already published and hereto attached and made a part of this contract. Said party of the first part further agrees to light said city after 1 o'clock in cases of fire occurring in the central wards of the city on the following conditions, viz.: So long as the city is lighted until 1 o'clock only under this contract, and provided the city will cause to be put into the company's power house at Sewall's Falls a fire alarm that shall be rung in at the same time that the fire alarm is given in the central wards of the city, said party of the first part, after commencing its business at Sewall's Falls, shall turn on the electric current immediately upon said fire alarm being given and shall cause the lights to burn for such time as may be needed or can be burned without injury to the company's apparatus and for these services shall make no charge to the city of Concord.

Said party of the first part agrees that after 3 years from the date of this contract, if it shall be found that cheaper methods of lighting are practicable, it will give to said party of the second part the benefits of the cheaper methods, provided the party of the second part will allow as a proper part of the cost the expense of making the change to said possible cheaper methods, so far as the cost of change affects the cost to the party of the first part of doing the business; and if the parties cannot agree as to the allowance to be made on account of the cheaper methods, the price shall be determined as follows:

The city government shall appoint one referee and the party of the first part shall appoint one referee and these two referees shall appoint another referee who shall be chairman, and the decision of these three referees shall be final.

The contract contains a paragraph relating to all night lighting, and others in which it is agreed to furnish lights of 2,000 candle power for $75 each until 1 o'clock and for $100 all night, and relating to other details. The contract is signed by George F. Page, duly authorized agent of the Concord Land and Water Power Company, and H. W. Clapp, agent of the city.

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—JOS. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 cents.

MONDAY, SEPTEMBER 12, 1892.

The Market for Gas Securities.

A weak and vacillating market, for the week ended Friday last, closed with Consolidated at the same point that it was a fortnight ago, which plain statement goes to show its latent strength. The general share market was weak, and even Chicago gas, which has been particularly strong during the dull summer season, shared in the depression. Another exception, however, to the slump in values is afforded in the instance of Citizens, of Brooklyn, which sold up to 114. Mutual is a trifle easier, at 140 to 145, while Equitable more than holds its own. It is difficult to secure a genuine figure in Mutual, for the stock is very firmly held. Standard is a trifle lower, as to both common and preferred. A pertinent question in respect to the local situation would be this: "Has the charter of the Company that *proposes* to tunnel the East River for the purpose of supplying the city with gas been offered for sale?" Over in Brooklyn strength and dullness are the ruling features, but it is almost time for the pyrotechnics to begin. Baltimore gas is about as it was a week ago. There is no particular change in the general situation. The securities of the Equity Company, of Brooklyn, are quoted to day for the first time in our columns.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

SEPTEMBER 12.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	116½	117x
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	153	155
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	140	145
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	35	—
Preferred	5,000,000	100	—	85
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	138
Citizens	1,200,000	20	113	113½
" S. F. Bonds	320,000	1000	—	103
Equity Gas Light Co	2,000,000	100	—	—
Bonds	1,000,000	—	—	85
Fulton Municipal	3,000,000	100	137	140
" Bonds	300,000		102	—
Peoples	1,000,000	10	94	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	—	118
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	145	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	132	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	87½	88½
2d " " "	3,000,000	1000	77	78
Bay State Gas Co.—				
Stock	5,000,000	50	56	57
Income Bonds	2,000,000	1000	77	78
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	79¾	79⅞
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7.650,000	1000	90½	90⅞
Equitable Gas & Fuel Co, Chicago, Bonds	2,000,000	1000	—	97½

WANTED,

A Position as Superintendent or Manager of Coal Gas Works.

Three years' experience. Good bookkeeper. Best references.
898-6 Address W. C. THOMSON, Spartanburg, S. C.

Position Wanted

As Superintendent or Manager of Gas Works

having a sendout of over 15 million feet per annum. Western States preferred. Address
901-2 "T.," care this Journal.

WANTED,

A Good Superintendent for a Small Gas Works.

One who will solicit new business and do fitting and fixture work, as well as attend to the manufacture of gas. Salary good. None but those with first-class references need apply. Address
901-4 "S.," care this Journal.

Situation Wanted.

The undersigned desires an engagement with some Company requiring the services of a practical man as

Superintendent or General Manager.

Has had 26 years' experience in all branches of manufacture and distribution of Coal and Water Gas, and office details. Can give best of references. T. A. BATES, 84 East 2d St.,
899-3 Portsmouth, Ohio.

Position Wanted

As Superintendent of Gas or Gas and Electric Works.

Twenty-five years' experience in the management and construction of same. No preference as to large or small works. A1 references. Address
898-6 "L.," care this Office.

FOR SALE.

SMALL GAS PLANT.

Excellent chance for gas man with limited capital to work up a good property. For particulars apply to
THEO. PLATE, Sec'y,
901-2 4th and Chestnut Sts., St. Louis, Mo.

For Sale.

A number of 12 ft. and 16 ft.

Siemens-Lungren Lamps.

In first-class order, and practically as good as new. Will sell at a bargain. Address
899-3 "LAMPS," care this Journal.

FOR SALE,

Four Purifying Boxes,

5 ft. by 5 ft. by 2 ft. 3 in. With Center Seal and all connections 6 inches, ready to put up. Apply to
H. HARTHAN, Supt. Gas & Elec. Lt. Co.,
898-4 Selma, Ala.

MOSES G. WILDER, MECH. ENGR.

816-18-20-22 Cherry St., Phila., Pa.

Volumetric Lamp Governors

FOR GAS LAMPS & HIGH-POWER BURNERS.

Governor Burners for Street Lamps & General Use

GOVERNORS FOR ARGAND AND OTHER COMMON GAS BURNERS IN ALL SIZES.

Horizontal Governors

Specially Adapted for Gas Stoves, Furnaces, etc.

It is well known that a large majority of all High Power Gas Lamps in the United States have my Governors attached, and they are always used by the leading makers of these lamps. To remove any excuse for the use by anyone of inferior and infringing Governors, a reduction in price has been made, and all exclusive contracts are cancelled.

Correspondence Solicited with all who require a Reliable Governor.

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
Ammonia Concentrator.
Not Expensive. Write to
STROH & OSIUS, Pat'ees, or
Mich. Ammonia Works, Detroit, Mich.

Coal Tar.

J. W. FORD,

153 Washington Street, Chicago, Ill.,

is always ready to buy Coal Tar.

DURAND WOODMAN, Ph.D.,

Analytic and Technical

CHEMIST.

Fuel and Gas Coals, Gas, Materials for Purification, Water, etc.

Laboratory, 127 Pearl (80 Beaver) St., N. Y.

TRANSMISSION OF POWER
BY MANILLA ROPE.

Copiously illustrated and described in Catalogue just issued.

LINK-BELT MACHINERY CO., - CHICAGO.

THE GAS WORKS CONSTRUCTION CO.

ENGINEERS AND CONTRACTORS

FOR THE

Erection of New or the Rebuilding of Old Works.

LAYING of CAST or WROUGHT IRON STREET MAINS.

Special Attention Paid to the Building of Holder Tanks.

Plans, Specifications and Estimates Furnished on Application.

2, 4 & 6 College Place, Room 7, N.Y.

Gas Bills

are receipted, dated and their Coupon cut off and delivered, dated, by one blow on the

COUPON CUTTER

Write for Pamphlet.

FELT & TARRANT MFG. CO. 52 to 56 Illinois St. CHICAGO.

Mistakes in Addition, Office Headache,

and mistakes in carrying forward don't occur where the Comptometer is used. It saves half the time in doing the work and all time in looking for errors. Solves with great rapidity and absolute accuracy all arithmetical problems. Write for pamphlet.

FELT & TARRANT MFG. CO., 52-56 ILLINOIS ST., CHICAGO.

FREDERIC EGNER & CO.,

GAS ENGINEERS.

812 Security Building (S. W. Corner Fourth and Locust Streets) - - - ST. LOUIS, MO.

Will contract to erect, alter or improve Gas Works, Water Works, and furnish approved apparatus for all purposes required in the business.

Builders of EGNER'S PATENT GAS APPARATUS for making Gas from any kind of Coal or Slack, for illuminating or power purposes.

AGENTS FOR THOS. B. FOGARTY'S PROCESS FOR MAKING AMMONIA AND FUEL GAS.

By using Gas Engines and Egner's Patent Gas Apparatus, manufacturers can save from 4 to 6 lbs. of Coal per indicated H.P. hour, and dispense with the smoke nuisance. This process for making gas has been successfully operated for years, and hence is not to be classified with untried experiments.

May be Consulted About New and Old Patented Methods of Making Gas, and will Superintend the Building of Works of any System.

Visiting Gas Men are invited to make our Office their headquarters and have their mail addressed here while in the city.

FORT WAYNE ELECTRIC CO.

MANUFACTURERS OF

Apparatus for Arc Lighting,
Direct Current and Alternating Incandescent Lighting,
and Power Transmission.

THE NEW WOOD GENERATOR AND MOTOR

HAVE THE FOLLOWING SPECIAL FEATURES OF MERIT:

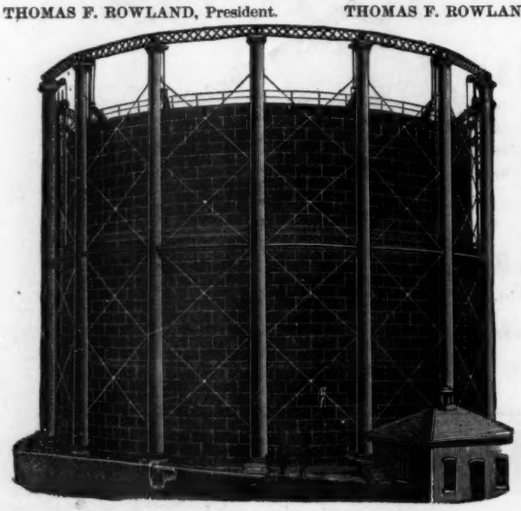
High Efficiency, Perfect Self-Regulation, Uniqueness and Simplicity of Design, Self-Oiling Expansion Boxes, Self-Contained Multiple Fuses, Anti-Friction and Insulating Sliding Base Frame, New Patent Fireproof and Indestructible Rheostat.

FOR FURTHER INFORMATION ADDRESS

FORT WAYNE ELECTRIC COMPANY, - - Fort Wayne, Ind.

The Continental Iron Works

THOMAS F. ROWLAND, President. THOMAS F. ROWLAND, Jr., Secretary & Treasurer. WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.



BROOKLYN, N. Y.

TAKE EAST TENTH OR TWENTY-THIRD STREET FERRIES FROM NEW YORK TO GREENPOINT.

BUILDERS OF

GAS HOLDERS.

Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers. Purifiers, Valves, Etc., Etc.

SELF-SEALING RETORT MOUTHPIECES & LIDS

For Round, Oval, or "D" Retorts.

Reliable Gas Heaters.

* **FINEST IN THE WORLD.** *

WE LEAD AS USUAL IN

VARIETY OF STYLES, SIZES,

AND ELEGANCE OF DESIGN.

Our New Parlor Gas Grates and Heaters,

WITH FIRE BRICK FILLING,

Resemble Hard Coal Fires,

and Heat as Well.

QUICK, CHEERFUL, AND CLEAN.

THE SCHNEIDER & TRENKAMP CO.,

Cleveland, Ohio.

Jewel Gas Stoves

ARE THE BEST.

MADE IN FIFTY-SEVEN STYLES.

Prices from 75 Cents to $66.00.

For Details we refer to the Jewel 1892 Catalog.

JEWEL FEATURES ARE:

Burners with Sawed Slots. Direct Needle Valves.

Good Mechanical Construction.

GEORGE M. CLARK & COMPANY,

Makers,

157-161 Superior Street,

CHICAGO.

THE HAZELTON BOILER.

The Handiest, Safest, and Most Economical Boiler.

THE HIGHEST STANDARD OF EXCELLENCE.

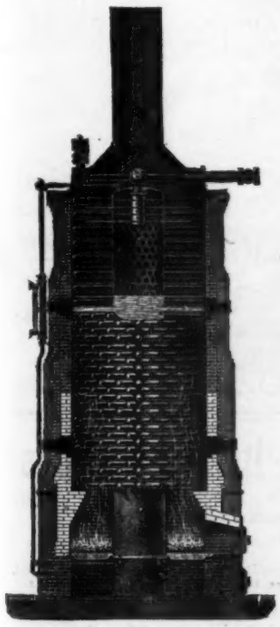
Patented in the United States and Foreign Countries.

THREE REGISTERED

THE HAZELTON BOILER.

THE PORCUPINE BOILER.

TRADE MARKS.



All Genuine Hazelton or Porcupine Boilers bear our Three Registered Trade Marks.

BEWARE OF IMITATIONS.

THE HAZELTON BOILER CO.,

MANUFACTURERS AND SOLE PROPRIETORS,

General Office, 716 E. Thirteenth St., Works, Avenue D and Thirteenth St., **New York, U.S.A.**

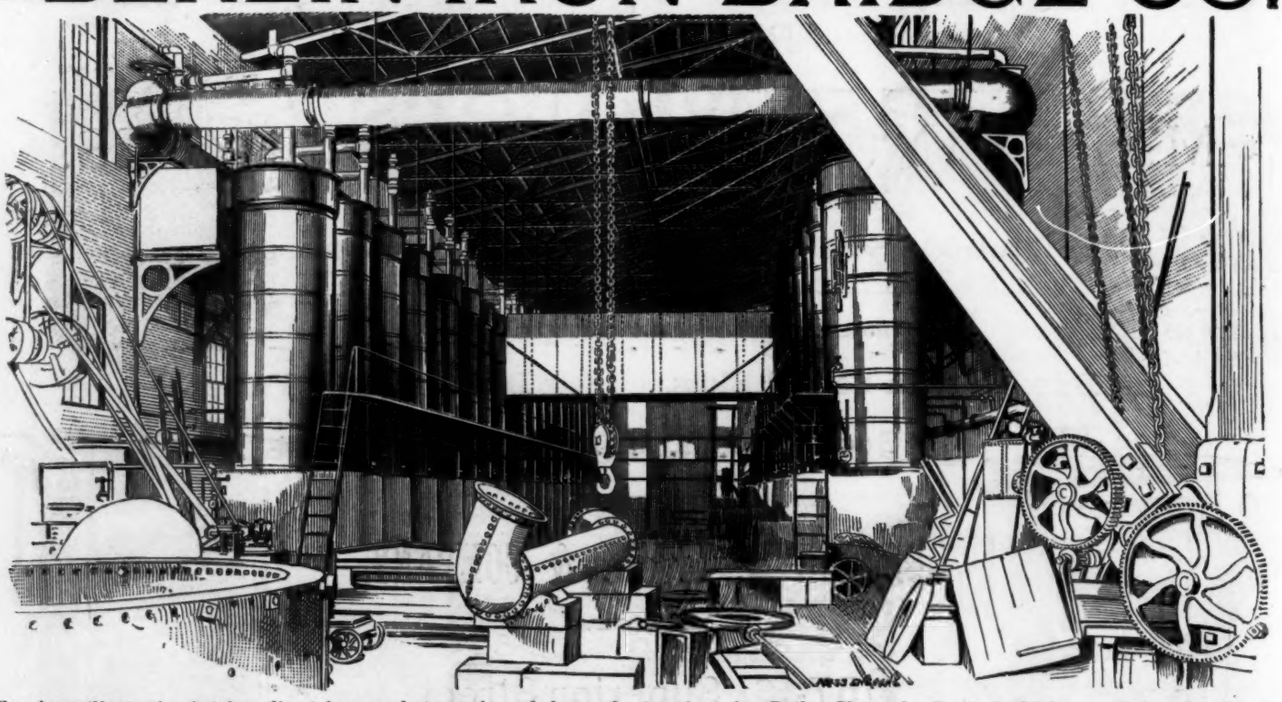
This Company is prepared to furnish Plants of Boilers of any desired capacity; solicits inspection of those now in operation, and will forward proposals and other information on application. All imitations of the substantial features of this boiler are infringements, and will be prosecuted to the full extent of the law. *Correspondence Solicited.*

The following are a few of the Gas Companies using this Boiler:

THE NEW YORK MUTUAL GAS LIGHT COMPANY	New York City.
THE NORTH ADAMS GAS LIGHT COMPANY	North Adams, Mass.
THE BOSTON GAS LIGHT COMPANY	Boston, Mass.
CONSOLIDATED GAS COMPANY	New York City.
CONSOLIDATED GAS AND ELECTRIC COMPANY	Port Chester N. Y.
HUDSON COUNTY GAS LIGHT COMPANY	Hoboken, N. J.
HAVERHILL GAS COMPANY	Haverhill, Mass.
ST. PAUL GAS LIGHT COMPANY	St. Paul, Minn.
NEWARK GAS LIGHT COMPANY	Newark, N. J.
THE NORTHERN GAS LIGHT COMPANY	New York City.
NASSAU GAS LIGHT COMPANY	Brooklyn, N. Y.
MILWAUKEE GAS LIGHT COMPANY	Milwaukee, Wis.
PITTSBURGH GAS LIGHT COMPANY	Pittsburgh, Pa.
MUTUAL FUEL GAS COMPANY	Chicago, Ill.

CHAS. M. JARVIS, Prest. & Chief Engineer BURR K. FIELD, Vice-President. FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary

THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph, and shows the interior of a Boiler Shop, the Roof of which was designed and built by us for the Amoskeag Manufacturing Company, at Manchester, N. H. The building is 75 feet in width by 275 feet in length, the walls being made of brick and the roof being made of iron—iron trusses, iron purlins, and covered with corrugated iron—so that there is absolutely no woodwork anywhere about the building which can take fire. For Boiler Rooms this construction particularly commends itself.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 104 High Street, Boston, Mass.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., No. 54 Pine St., N. Y.

BINDER for the JOURNAL.

STRONG.

DURABLE.

LIGHT.

SIMPLE

CHEAP.

HANDSOME.

Price, $1.

A.M. Callende. & Co.,

32 Pine st.,

N.Y. City.

Fuel and Its Applications

By E. J. MILLS, D.Sc. F.R.S., and F. J. ROWAN, C.E., assisted by others, including Mr. F. P. Dewey, of the Smithsonian Inst., Wash., D. C.

7 PLATES, AND 607 OTHER ILLUSTRATIONS. ROYAL OCTAVO, PAGES XX, 802. HANDSOME CLOTH, $7.50.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text, and much of it has been rewritten and otherwise improved. Price, cloth, $6. A. M. CALLENDER & CO., 32 Pine St. N. Y.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

MANUFACTURERS OF

Standard 3 Diaphragm Dry Meter.

Gas Meters,

STATION METERS,

METER PROVERS, PHOTOMETERS,

Experimental Meters of all Kinds,

AND

Standard 2 Diaphragm Dry Meter.

Apparatus for Testing the Quantity and Quality of Gases.

GAS STOVES

OF ALL SIZES AND FOR ALL PURPOSES.

Catalogues showing New Designs will be sent upon application.

MANUFACTORIES,

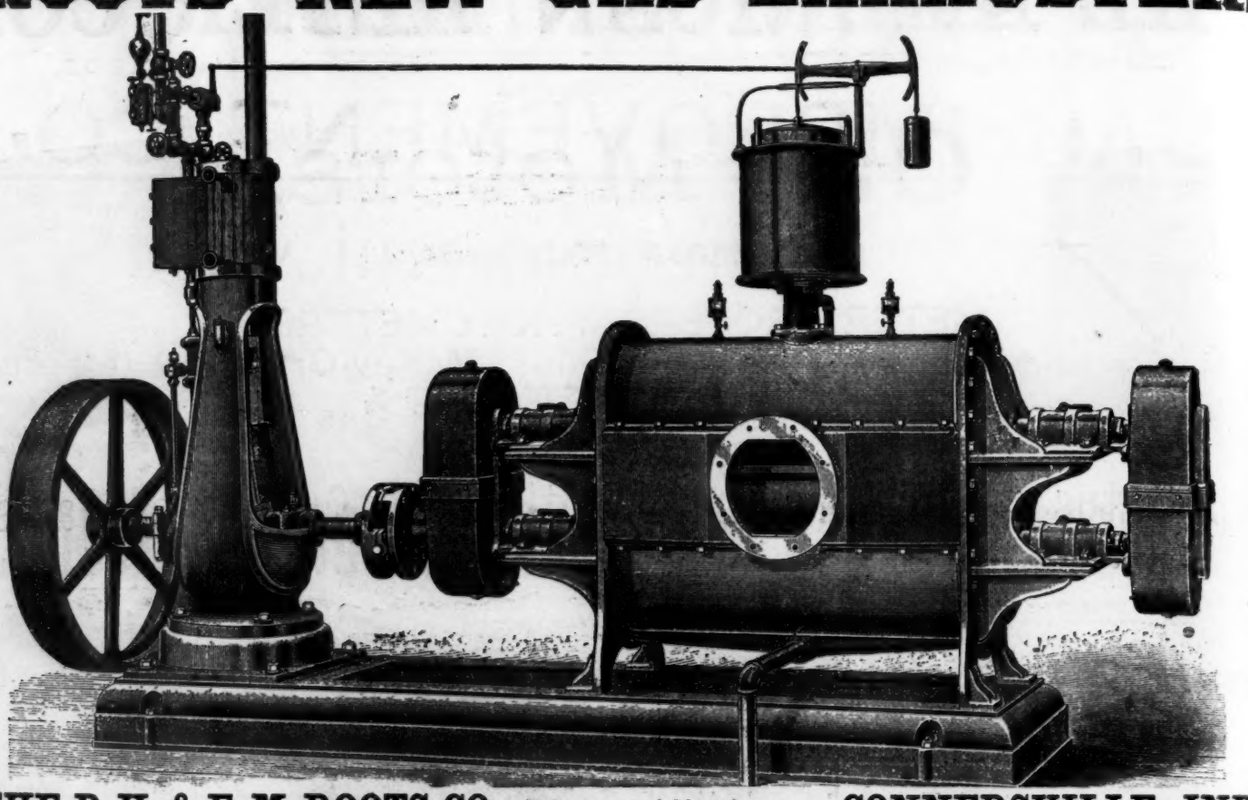
508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second Sts., Phila. 125 & 127 S. Clinton St., Chicago.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street San Francisco Cal.
No. 810 North Second Street, St. Louis, Mo.

GAS STOVE SHOW ROOMS, 242 Sixth Avenue, New York City.

ROOTS' NEW GAS EXHAUSTER.



THE P. H. & F. M. ROOTS CO., Patentees and Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, Gen. Agts., COOKE & CO., Selling Agts., 163 & 165 Washington St., N. Y.

THE WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the Tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, six years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. Several have been erected in the United States.

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2¾-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers.

"C. A. GERDENIER, Supt. Bridgeport (Conn.) Gas Lt. Co."

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results guaranteed in every instance.

GEO. SHEPARD PAGE'S SONS, Sole Agts. for Western Hemisphere, 69 Wall St., N. Y.

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

J. P. WHITTIER, 70 Rush St., near Division Av., Brooklyn, N. Y.

A Large Quantity of Ground Fire Brick For Sale Cheap.

1892 DIRECTORY 1892

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - - $5.00.

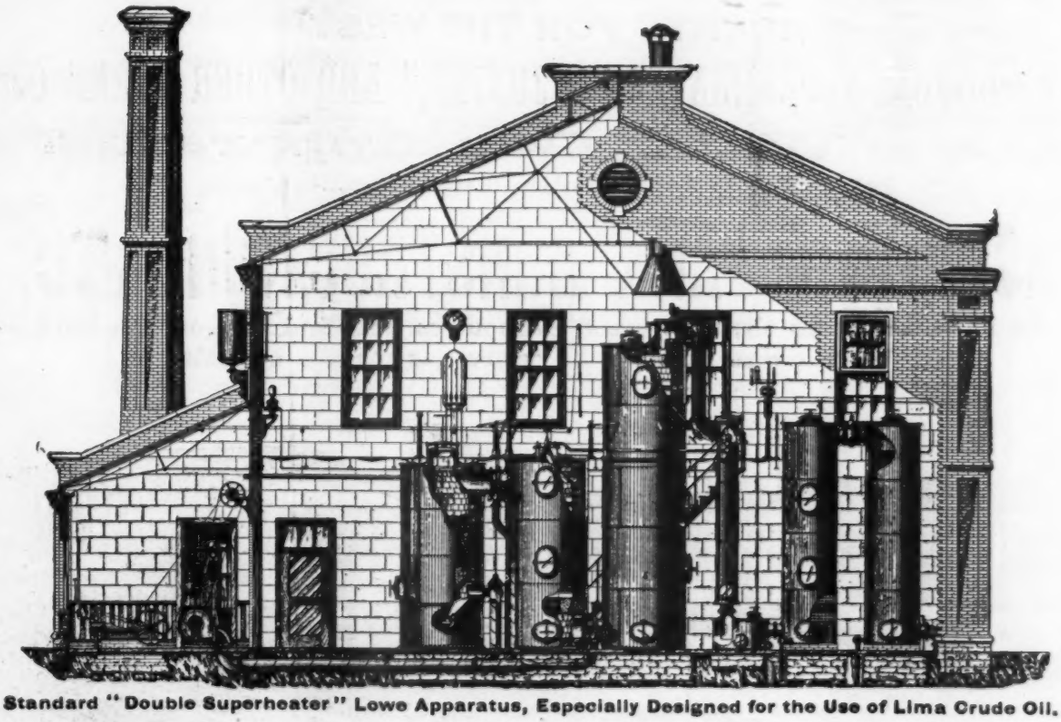
A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Owners of the Lowe, Granger-Collins, McKay-Critchlow (for carbureting Natural Gas), and Other Gas Patents.

BUILDERS, LESSEES and PURCHASERS OF GAS WORKS.



Standard "Double Superheater" Lowe Apparatus, Especially Designed for the Use of Lima Crude Oil.

Erectors of

WATER GAS PLANTS,

(Either Independent or Auxiliary to Coal Gas Works),

USING LIMA OR OTHER LOW GRADE OILS AND ANTHRACITE COAL OR GAS HOUSE OR OVEN COKE.

PAMPHLETS, PLANS, AND ESTIMATES FURNISHED UPON APPLICATION.

NATIONAL GAS LIGHT AND FUEL CO.,

No. 52 Lake Street, Chicago.

ALTEN S. MILLER, Manager.

GAS WORKS

Built, Remodeled, Leased, or Purchased.

Sole Builders OF THE Springer Cupola System,

Including Solid Arch, "Sliding" or "Bye-Pass" Combustion Valve Forms, and all Modern Improvements.

Also, by Special Arrangement with the United Gas Improvement Company,

AGENTS FOR THE WEST

FOR THE "DOUBLE-SUPERHEATER," "JUNIOR," AND OTHER FORMS OF THE

Lowe Water Gas Apparatus.

Full Information Furnished upon Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of

Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE, - - - No. 15 Cortlandt Street, N. Y. City.

NATIONAL GAS AND WATER CO.,

218 La Salle St., Chicago, Ill.

C. D. HAUK, President. HENRY C. REW, Vice-Prest. N. A. McCLARY, Secretary. IRWIN REW, Treasurer. E. E. MORRELL, Engineer.

BUILDERS AND OPERATORS OF

Gas Works and Water Works.

WATER GAS APPARATUS A SPECIALTY.

Guaranteed Estimates of Cost of Gas in Holder Furnished upon Application.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION! REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 351 Canal St., New York.

WILBRAHAM
GAS EXHAUSTER & ENGINE COMBINED.

WILBRAHAM BROS.,

PHILADELPHIA, PA.

IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

Greenpoint Chemical Works.

JOHN SCHRIEVER, Manager.

Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

DOUGLAS' FERRIC OXIDE

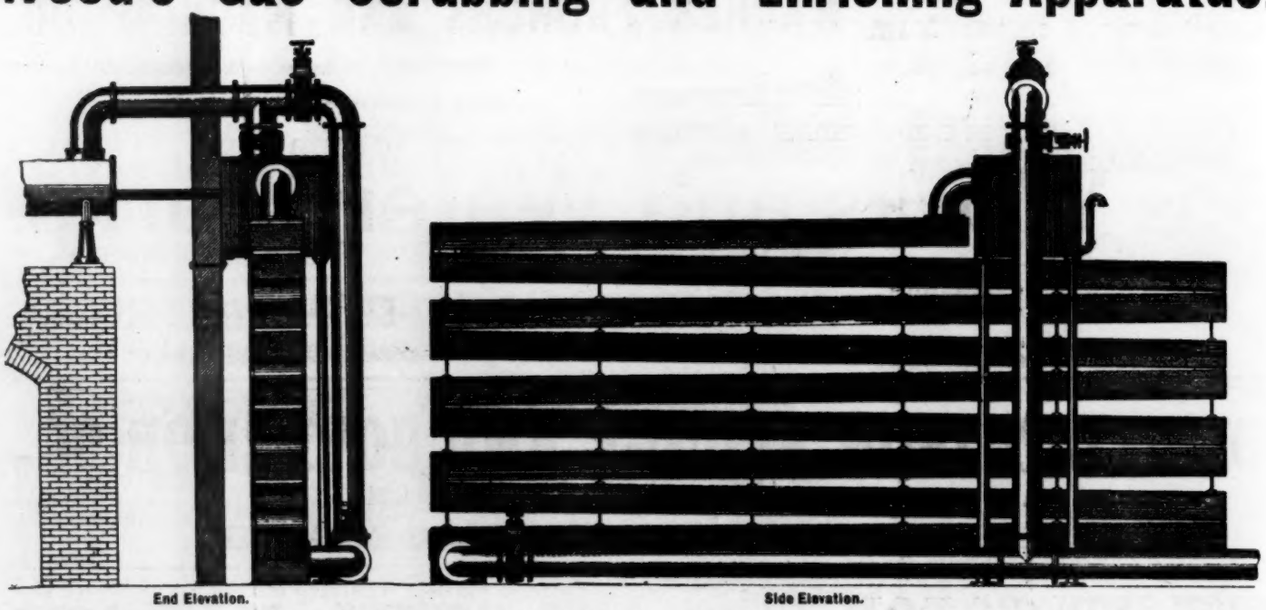
For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

Full information, with references to many users, and prices delivered in any locality, furnished on application to

H.W. Douglas (Supt. Ann Arbor Gas Company) **Ann Arbor, Mich.**

Wood's Gas Scrubbing and Enriching Apparatus.



End Elevation. Side Elevation.

The cheapest, simplest, and most effective apparatus for removing Tar and Ammonia, and enriching Gas, ever brought to the attention of Gas Manufacturers. With ordinary condensers and scrubbers the condensable illuminants flow off to the tar wells and liquor tanks and are lost, but with Wood's Apparatus these illuminants are saved and retained in the gas, thus increasing its illuminating power and making a great saving in the cost of enriching material. Where set up next after the Hydraulic main, this Scrubber produces an 8-oz. Ammoniacal Liquor.

JAMES R. FLOYD & SONS, - - Nos. 531 to 543 West 20th Street, N. Y. City.

THE "LITTLE GIANT" WATER GAS GENERATOR.

In order to correct some of the drawbacks in existing apparatus, and to bring Water Gas Generators within the reach of all Gas Companies, I have completed a Gas Generator (which can be seen in daily operation) having many advantages over all others.

This Generator takes but little room. It requires no change to be made in the height or depth of gas houses. It is more easily repaired when necessary. It is simpler and easier operated. It makes *more good gas from a given quantity of stock.* It makes good gas from *cheaper stock.* It makes gas of *any desired candle power* up to thirty without smoke. It makes a faultless gas from whatever gas-producing materials are cheapest in the locality where required, using hard coal or coke in connection with Lima crude or any other crude petroleum or its distillates, including *Naphtha of any specific gravity.* I build these Generators with any required capacity from 3,000 cubic feet per hour upward.

In more than one-half the gas works in the country the "Little Giant" will enable *one man* to easily make, in *five hours,* all the gas needed for the *twenty-four* hours.

I have decided to take orders for these Generators for the balance of this season at *one half the price of any other* Water Gas Generator of equal capacity now on the market. After that the price shall be raised. *Everything is guaranteed,* including durability and capacity of the Generator, the quality of the gas, and its cost.

Correspondence solicited.

A. M. SUTHERLAND, - - No. 115 Broadway, N. Y. City.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng.,

Having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

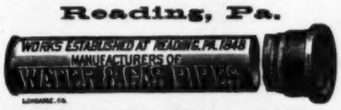
A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

ENGINEERS. GAS AND WATER PIPES. GAS AND WATER PIPES.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd.
and READING FOUNDRY CO., Ltd.

Reading, Pa.



Specials—Flange Pipe, Valves and Hydrants Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

JOHN FOX, Selling Agent. **160 Broadway, N.Y.**

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

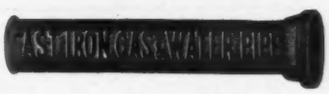
BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

M. J. DRUMMOND,



SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

THE ADDYSTON PIPE AND STEEL COMPANY.

CAST IRON

PIPE

CINCINNATI, OHIO.

FOR MANUFACTURED AND NATURAL GAS AND WATER.

SPECIALS, FLANGE PIPE, AND LAMP POSTS

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, **SERVICE CLEANERS, DRIP PUMPS,** and **STREET MAIN PROVING APPARATUS.**

C. A. GEFRORER,
248 N. 8th St., Phila., Pa.

JAS. McMILLAN, Prest. HUGH McMILLAN, Vice-Prest. W. C. McMILLAN, Sec & Treas. J. H. WHITING, Gen. Supt.

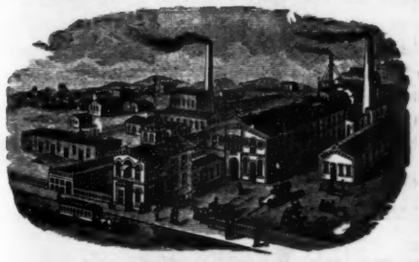
DETROIT PIPE & FOUNDRY CO.,

DETROIT, MICH.

Flange Pipe, Branches & Special Castings.

GENERAL FOUNDRY WORK.

LUDLOW VALVE MFG. CO.



OFFICE AND WORKS,
938 to 954 River Street and 67 to 83 Vail Av.,
TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants.
Send for Circulars.

Valves.—Double and Single Gate, ¼ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil.
Send for Circulars.

GREENOUGH'S
"DIGEST OF GAS LAW."

Price, $5.00.

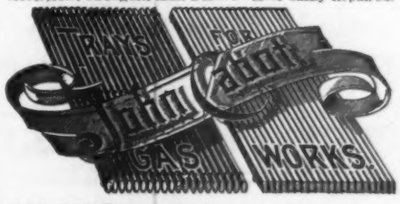
This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.



306-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.
Send for Circulars.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

WORKS & GEN'L OFFICE: **Indian Orchard, Mass.**

TREASURER'S OFFICE: **72 Kilby & 112 Milk Sts, Boston, Mass**

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

J. H. GAUTIER & COMPANY
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
H. GAUTIER, Prest. CHAS. E. GAUTIER, Sec. & Treas.
CHAS. E. GREGORY, V.-Prest. DAVID R. DALY Gen'l Mang'r.

BROOKLYN
Clay Retort & Fire Brick Works,
(EDWARD D. WHITE & CO.)
Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.
VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y

CYRUS BORGNER, Successor to

Works,
LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
JAMES GARDNER, JR.,
Successor to WILLIAM GARDNER & SON.
Office, Rooms 19 & 20, Lewis Block
PITTSBURGH, PA. P. O. Box 373
Fire Clay Goods for Gas Works.
SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.
H. A. NORTON, No. 92 WATER STREET, BOSTON, MASS., Agent for the New England States.

HENRY MAURER & SON,
(ESTABLISHED 1866.)
EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS
WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.
Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.
A Cement of great value for patching retorts, putting on mouth-pieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.
PRICE LIST.
In Casks, 600 to 800 lbs., f.o.b. N. Y., at 5 cents per pound.
In Kegs, 100 to 300 lbs., " " at 6 " "
In Kegs less than 100 lbs., " " at 7 " "
C. L. GEROULD & CO.,
5 & 7 Skillman St., Brooklyn, N. Y.
Western Agent, H. T. GEROULD, Wichita, Kan.

Parker-Russell Mining and Mfg. Co.,
CITY OFFICE,
Mermod-Jaccard Bldg., Rooms 307 & 308,
Broadway & Locust St., St. Louis, Mo.
PROPRIETORS OF THE
OAKHILL GAS RETORT & FIRE BRICK W'KS
Our immense establishment is now employed almost entirely in the manufacture of
Materials for Gas Companies
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We have the *exclusive Agency for the West* of the celebrated
Kloenne-Bredel Full Depth and Semi-Recuperator Benches,
And also furnish and build
Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Coke as fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.
BALTIMORE
RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT BALTIMORE MD.
Clay Retorts, Blocks & Tiles
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS
Sole Agents the New England States.

King's Treatise on Coal Gas.
In Three Volumes. Price per Vol., $10. Sold either by Volume or in Sets.
A Standard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine and of Gas Cooking and Heating Appliances.
A. M. CALLENDER & CO., 32 Pine Street, N. Y. City

FRED. BREDEL, C. E.,

PROP'R OF KLOENNE AND BREDEL PATENTS.

Recuperative Furnaces, Purifying Machines,

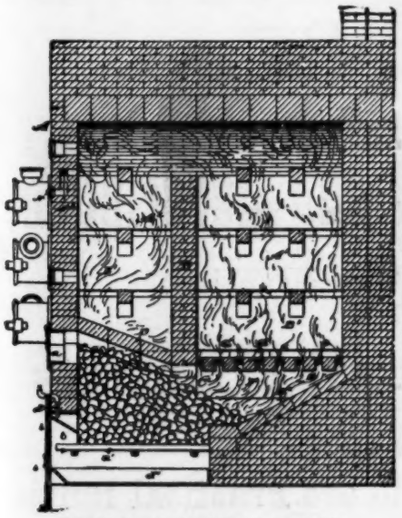
* Gas Apparatus. *

Main Office, 118 Farwell Avenue, Milwaukee, Wis.

New York Office, 22 Beaver Street.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

AMERICAN GAS LIGHT JOURNAL

$3.00 per Annum.

A. M. CALLENDER & CO.

32 Pine Street, N. Y.

The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

350 Pages, Full Gilt Morocco. Price, $3.00.

A. M. CALLLENDER & CO., 32 Pine St., N. Y.

DAVIS & FARNUM MFG. CO.,

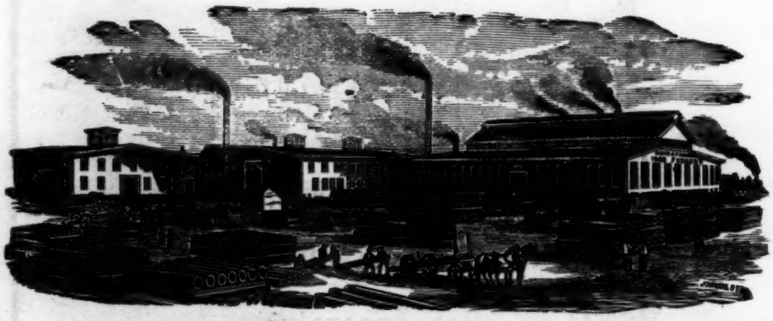
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, Waltham, Mass. BOSTON OFFICE, Room 18, Vulcan Building, 8 Oliver Street.

SINGLE, DOUBLE, AND TRIPLE LIFT

Gasholders.

OF ANY CAPACITY.



TUBULAR, PIPE, AND SINUOUS FRICTION

Condensers.

OF ALL SIZES.

IRON ROOF FRAMES AND FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant

— ALSO —

Gas and Water Pipe, Flanged Pipe,

Sugar House Work, and Special Castings of all Descriptions.

Established 1861. Incorporated 1881.

KERR MURRAY MFG. CO.,

FORT WAYNE, IND.

Those who are in need of

Holders or Gas Works Apparatus of any Description,

AND OF THE LATEST IMPROVEMENTS,

will find it to their interest to

GET AN ESTIMATE FROM US

before placing their order.

As we make a Specialty of this Class of Work, and are Practical Builders and Manufacturers of same,

with our long years of experience in the business,

WE CAN GUARANTEE YOU SATISFACTION.

Estimates, Plans and Specifications Furnished on Application.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

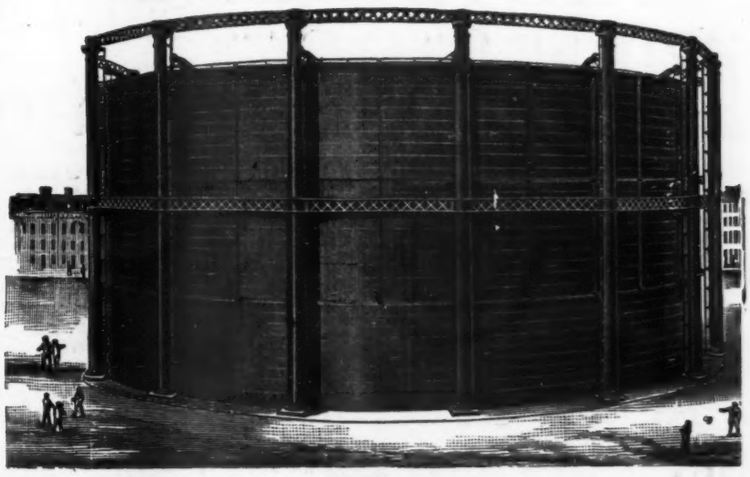
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED —1821.— Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,

Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings.

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

Foundries and Works: { Millville, N. J. / Florence, " / Camden, "

R. D. WOOD & CO.

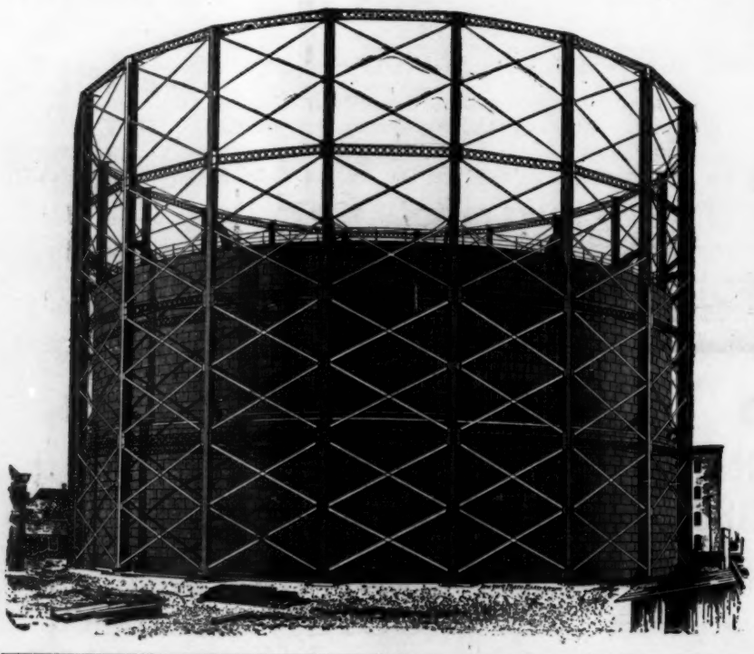
Engineers, Iron Founders, Machinists.

No. 400 Chestnut Street,

PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE.



GAS HOLDERS

SINGLE, DOUBLE AND TRIPLE LIFTS,
WITH OR WITHOUT
WROUGHT IRON OR STEEL TANKS.

PURIFIERS. CONDENSERS. SCRUBBERS.

SOLE MAKERS OF

The Standard Mitchell Scrubbers.

(PATENTED)

THE HOPPER AUTOMATIC GAS GOVERNOR,
BENCH WORK,
PLATE GIRDERS, IRON FLOORS AND ROOFS,
THE TAYLOR REVOLVING-BOTTOM GAS-PRODUCER,
HEAVY LOAM CASTINGS.

HYDRAULIC WORK,
LAMP POSTS, VALVES, ETC.

ISBELL-PORTER COMPANY,

G. G. PORTER, Prest. (Successors to SMITH & SAYRE MFG. COMPANY) CHAS. W. ISBELL, Secy.

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

Special Castings, Tees, Bends, etc.
Bench Castings.
Water Gas Generators.
Hydraulic Mains.
Iron Floors.
Brenner Self-Sealing Retort Lids.
Tar Gates and Hydraulic Main Dip Regulators.
Hutchison's Tar Displacement Apparatus.
Multitubular Condensers.
Standard Washer-Scrubbers.
Tower Scrubbers.
Walker's Tar and Carbonic Acid Extractors.
Exhausters.
Engines.
Steam Jet Exhausters.
Exhauster Governors.
Compensators.
Self-Acting Bye-Pass Valves.
Valves.
Valve Stands with Indicators.
Purifying Boxes.
Purifier Valve System.
Center Seals.
Street Governors.

Estimates, Drawings and Specifications Furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

ISBELL-PORTER COMPANY,

No. 245 Broadway, New York City.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,

(SUCCESSORS TO HERRING & FLOYD)

Oregon Iron Works,

W. 20th & 21st. Sts., bet. 10th & 11th Avs.,

NEW YORK CITY.

Engineers and Contractors

FOR THE

CONSTRUCTION OF GAS WORKS.

MANUFACTURERS OF

All Kinds of Castings and General Ironwork

FOR

GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings.

Condensers, Scrubbers, Purifiers, Street Drips and Connections,

Valves,

Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.

Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

Bouton Foundry Co.,

FOUNDERS AND MACHINISTS,

CHICAGO, ILL.

Gas Works Apparatus,

PURIFIERS, CONDENSERS,

Bench Work

SPECIALS. LAMP POSTS,

SCRUBBERS,

Iron Roofs and Floors.

Plans and Estimates furnished for new works or extensions of old works.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.

Foundry: 33, 35, 37 & 39 Mill Street. **Wrought Iron Works:** 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

1842. **DEILY & FOWLER,** 1892.

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

GASHOLDERS,

Single and Telescopic.

Holders Built 1885 to 1891, Inclusive

Chester, Pa.	Little Rock, Ark.	Northern Gas Lt. Co., of	Calais, Me.	Victoria, B. C.
Hazleton, Pa. (2d.)	Irvington, N. Y.	New York, N. Y.	New London, Conn. (2d)	Vancouver, B. C.
Staten Island, N. Y.	South Boston, Mass.	Willimantic, Conn	West Chester, N. Y.	Charlottesville, Va.
Saugerties, N. Y.	Rye, N. Y. (2)	Montclair, N. J.	Bay Shore, L. I.	So. Framingham, Mass.
Clinton, Mass. (Lan. Mills)	Woodstock, Ont.	Attleboro, Mass.	Washington, D. C.	Woonsocket, R.
Chattanooga, Tenn.	Malden, Mass.	Santa Cruz, Cal.	Newport, R. I. (2d)	Simcoe, Can.
Galveston, Texas. (3d.)	Staten Island, N. Y. (2d)	Erie, Pa. (3d)	Morristown, N. J.	Pittsfield, Mass. (2d)
Fort Plain, N. Y.	Woodstock, Ont.	West Chester, Pa. (3d	Lebanon, Pa.	Chattanooga, Tenn. (2d)
Brunswick, Ga.	Malden, Mass.	Lancaster, Pa. (3d	Oakland, Cal.	So. Bethlehem, Pa. (2d)
Port Chester, N. Y.	Paducah, Ky.	Tacony, Pa. (two)	Central Gas Lt. Co., New York City (2d)	"Vassar College," N. Y
New Rochelle, N. Y.	Norwich, Conn.	Mount Vernon, N. Y		So. Chester, Pa.
Salem, N. J. (3d)	Seattle, W. T.	Binghamton, N. Y.	Tacoma, Wash.	Cumberland, Md.
Omaha, Neb. (2d)	San Diego, Cal.	Concord, N. H.	Knoxville, Tenn.	Auburn, N. Y.
Lynn, Mass. (2d)	Westerly, R. I.	Dover, Del. (2d)	Pottstown, Pa.	DesMoines, Ia.

ILLUMINATING GAS! FUEL GAS!

The Loomis Process.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Sons' Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.

Plans and Estimates Furnished

GAS COALS. CANNEL COALS. COKE CRUSHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

This Colliery is located at Scott Haven, Pa., in the center of the Youghiogheny Gas Coal District, and produces the only reliable Youghiogheny Coal for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

Shipment from LOCUST POINT, BALTIMORE.

ALSO, SOLE SHIPPERS OF THE

Old Kentucky Shale, From Kentucky.

TRADE **O. K. SHALE.** MARK.

THE MOST VALUABLE GAS ENRICHER NOW AVAILABLE IN ANY DESIRED QUANTITY.

S. CALVERT FORD, Government Inspector at Washington, pronounces this Shale

"ONE OF THE BEST GAS ENRICHERS THAT HAS BEEN OFFERED TO THE TRADE."

He reports it as giving:

12,553 Cu. Ft. of 50-Candle Gas, or 10,460 Cu. Ft. of 60-Candle Gas, } **An Equivalent of 627,650 Candle Feet,** { And 808 Pounds of Merchantable Coke.

Single carloads or more delivered at any required point in the United States and Canada. Cargo shipments from

New York, Philadelphia, Baltimore and Newport News.

WE CAN ALSO SUPPLY A LIMITED QUANTITY OF

BRECKENRIDGE CANNEL.

Particulars as to Prices, etc., furnished upon application to the above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for U.S., Room 70, Nos. 2 & 4 Stone St., N.Y. City.

Keller's Adjustable Coke Crusher

SIMPLE, STRONG, AND DURABLE.

O. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.
Correspondence Solicited.

GAS ENRICHERS. GAS COALS. GAS COALS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 44 South Street, Baltimore, Md

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. { BANGS & HORTON, 60 Congress St., Boston.

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

H. C. SLANEY,

Gas Engineer

446 E. 116th Street, New York.

Plans, Specifications and Estimates furnished for New Works, Alteration or Extension of Old Plants.

JAMES R. SMEDBERG,

Gas Engineer,

213 Jefferson Ave., Peoria, Ill.,

Will furnish Plans, Specifications and Estimates for the Remodeling or extension of Gas Works. Also, Analytic Reports upon the business condition and prospects of Gas Companies. Ample references will be given.

The Chemistry of Illuminating Gas.

By NORTON H. HUMPHRYS. Price, $2.40.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

THE

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City

EDMUND H. MCCULLOUGH, Prest CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
No. 52 Dey Street, NEW YORK. No. 75 North Clinton Street, CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

A. HARRIS. E. L. HARRIS. J. A. HARRIS.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Phila., Pa. Agency, 67 & 69 S. Canal Street, Chicago.

S. S. STRATTON, Manager, Chicago.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Prest. WM. H. McFADDEN, Vice-Prest. (Phila.) WM. N. MILSTED, Gen. Supt. and Treas. (New York). WM. H. DOWN, Sec.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS.
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
125 & 127 S. Clinton Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS, STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

D. McDONALD & CO.,

Established 1854.

154 West 27th Street, NEW YORK CITY.
51, 53 & 55 Lancaster St., ALBANY, N. Y.
34 & 36 W. Monroe St., CHICAGO, ILL.

MANUFACTURERS OF

Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

Meters of all makers Thoroughly Repaired.

CHAS. V. NEWMAN, Western Mangr.,
1434-1435, Unity Bldg., Chicago, Ills.

DRY GAS METERS.
STATION METERS.
METER PROVERS.
REPAIRING.

SPECIAL.—Having purchased the sole right to manufacture and sell meters with the HEARNE IMPROVED VALVE, in the U. S., we respectfully solicit orders for the same.

The superior feature of this meter is that it avoids the danger of displacement of the valves, and consequent loss of gas, either in shipping, handling, or by dishonest consumers.

To designate from the regular Glover Meter, also made by us, we style the above the HEARNE-GLOVER Meter.

It is worth your consideration.

Full descriptive circular sent on application.

W. WALLACE GOODWIN, Prest. CALEB G. RIDGWAY, Vice-Prest. & Treas. CHARLES PAIST, Sec. H. B. GOODWIN, Supt. & Gen'l Mangr.

THE GOODWIN METER CO.,

1012, 1014 & 1016 Filbert Street, Philadelphia, Pa.

Agts., GEO. B. EDWARDS, 113 Chambers St., N.Y. ⁂ WALDO BROS., 88 Water St., Boston. ⁂ 44 & 46 Dearborn St., CHICAGO.

SOLE MANUFACTURERS OF THE

"Sun Dial" Gas Stoves,

IN A GREAT VARIETY OF STYLES AND SIZES.

Gas Cooking Stove No. 7C.

The Most Economical, Efficient, and Durable Gas Stove Made.

SIZE.

Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high.	9¼ inches high.	10 inches high.	21 inches high.
17 inches wide.	15 inches wide.	15 inches wide.	16 inches wide.
	12¾ inches deep.	12¾ inches deep.	
	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1¼ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1¼ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

Catalogue showing Styles and Prices sent free on application.

DRY and WET GAS METERS

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc.

METER PROVERS (Sizes 2, 5 and 10 feet.)

Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.

DRY & WET CENTER SEALS, DRY & WET GOVERNORS, EXHAUSTER GOVERNORS.

Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus Complete.

Also, TESTING AND CHEMICAL APPARATUS OF ALL KINDS, AND OF THE MOST PERFECT DESCRIPTION, FOR ALL PURPOSES RELATING TO GAS.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Agents for Bray's Patent Gas Burners and Lanterns.

Special attention to Repairs of Meters and all Apparatus connected with the business. All work guaranteed first-class in every particular. Orders filled promptly.